L TVCSTROKETEST USER'S PAGE NO. 1 E0 S3

```
R1000   NAME      STROKE TEST PACKAGE   (INCLUDING INITIALIZATION PACKAGE)
R1001   ORIGINAL CODING BY OLSSON        LOG SECTION....STROKE TEST PACKAGE
R1002   MOD BY ENGEL                    DATE....21 MARCH, 1967

R1003   FUNCTIONAL DESCRIPTION....
R1004        STROKE TEST PACKAGE GENERATES A WAVEFORM DESIGNED TO EXCITE BENDING
R1005        STRKTSTI (STROKE TEST INITIALIZATION) IS CALLED AS A JOB BY V88.
R1006                 IT INITIALIZES ALL ERASABLES REQD FOR A STROKE TEST, AND
R1007                 THEN TESTS FOR AN 80MS DAP. IF 80MS IT SETS STROKER = ESTROKER
R1009                 FOR AN IMMEDIATE STROKE TEST, OTHERWISE IT MERELY ENABLES
R1010                 A STROKE TEST BY SETTING STROKER TO -0. THE STROKE TEST
R1011                 THEN AWAITS SWITCHOVER TO THE 80MS DAP WHEREUPON IT IS
R1012                 ENABLED AFTER AN ADDITIONAL 4 SECOND DELAY TO AVOID
R1013                 THE SWITCHOVER TRANSIENTS (SEE STRKCALL, STRKUP IN
R1014                 TVCEXECUTIVE)
R1015        HACK (STROKE TEST) GENERATES THE WAVEFORM BY DUMPING PULSE BURSTS
R1016                 OF PROPER SIGN AND IN PROPER SEQUENCE DIRECTLY INTO
R1017                 TVCPITCH, WORKING IN CONJUNCTION WITH BOTH PITCH AND YAW
R1018                 TVC DAPS, WITH INTERMEDIATE WAITLIST CALLS. NOTE, HOWEVER
R1019                 THAT THE STROKE TEST IS PERFORMED ONLY IN THE PITCH AXIS.
R1020                 AN EXAMPLE WAVEFORM IS GIVEN BELOW, TO DEMONSTRATE STROKE-
R1021                 TEST PARAMETER SELECTION
R1022        RESTARTS CAUSE TEST TO BE TERMINATED. ANOTHER V68 REQD IF TEST
R1023                 IS TO BE RE-RUN.
R1027        PULSE BURST SIZE IS PAD-LOADED (ESTROKER) SO THAT AMPLITUDE OF
R1028                 WAVEFORM CAN BE CHANGED.  THERE ARE TEN PULSE BURSTS IN
R1029                 THE HALF-AMPLITUDE OF THE FIRST FREQUENCY SET IN THE
R1030                 STANDARD WAVEFORM.  AMPLITUDE IS 10(ESTROKER)(1/42.15),
R1031                 NOMINALLY 50/42.15  =  1.185 DEG
R1032   CALLING SEQUENCE....
R1033        EXTENDED VERB 68 SETS UP STRKTSTI JOB
R1034        PITCH AND YAW TVCDAPS, FINDING STROKER NON-ZERO, DO A  ..TC HACK..
R1035        AN INTERNALLY-GENERATED WAITLIST CALL ENTERS AT  ..HACKWLST..
R1036   NORMAL EXIT MODES....
R1037        TC BUNKER  (..Q.. IF ENTRY FROM DAP, ..TCTSKOVR.. IF FROM WAITLIST)LIST
R1039   SUBROUTINES CALLED....
R1040        WAITLIST
R1041   ALARM OR ABORT EXIT MODES....
R1042        NONE
R1043   ERASABLE INITIALIZATION REQUIRED....
R1044        ESTROKER (PAD-LOAD)
R1045        STROKER,  CADDY,  REVS,  CARD,  N
R1046   OUTPUT....
R1047        STRKTSTI...INITIALIZATION FOR STROKE TEST
R1048        HACK, HACKWLST...PULSE BURSTS INTO TVCPITCH VIA..ADS..
R1049                         RESETS STROKER = +0 WHEN TEST COMPLETED
R1050   DEBRIS....
R1051        N = CADDY = +0,  CARD = -0,  REVS = -1
R1052        BUNKER
R1053
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```
P1054   EXAMPLE STROKE TEST WAVE FORM, DEMONSTRATING PARAMETER SELECTION
R1055   NOTE....THIS IS NOT THE OFFICIAL WAVEFORM....

R1056           **            **
R1058           **            **
R1080           **            **          EXAMPLE WAVEFORM (EACH * REPRESENTS
R1082          * *           * *               85.41 ARCSEC OF ACTUATOR CMND)
R1084          * *           * *
R1088          * *           * *
R1088         *   *         *   *        **    **    **    **    **
R1070         *   *         *   *        **    **    **    **    **
R1072         *   *         *   *        **    **    **    **    **
R1074        *     *       *     *      * *   * *   * *   * *   * *   ** ** ** ** **
R1078        *     *       *     *      * *   * *   * *   * *   * *   ** ** ** ** **
R1078        *     *       *     *      * *   * *   * *   * *   * *   ** ** ** ** **
R1080   ------------------------------------------------------------------------------
R1082             *     *       *     *   * *   * *   * *   * *   * *  ** ** ** ** **
R1084             *     *       *     *   * *   * *   * *   * *   * *  ** ** ** ** **
R1088             *     *       *     *   * *   * *   * *   * *   * *  ** ** ** ** **
R1088              *   *         *   *     **    **    **    **    **
R1090              *   *         *   *     **    **    **    **    **
R1092              *   *         *   *     **    **    **    **    **
R1094               * *           * *
R1098               * *           * *
R1098               * *           * *
R1100                **            **
R1102                **            **
R1104                **            **
R1105   FOR THIS (UNOFFICIAL, EXAMPLE) WAVEFORM, THE REQUIRED PARAMETERS ARE AS FOLLOWS....

R1107       PCARD    = +3    (NUMBER OF SETS)
R1108       ESTROKER = +3    (PULSE BURST SIZE, SC.AT 85.41 ARCSEC/BIT)

R1109       SET1..
R1110           PREVS  = +3  (NUMBER REVERSALS MINUS 1)
R1111           PCADDY = +4  (NUMBER OF PULSE BURSTS IN 1/2 AMPLITUDE)
R1112       SET2..
R1113           PCARD1 = +9  (NUMBER REVERSALS MINUS 1)
R1114           PCARD4 = +2  (NUMBER OF PULSE BURSTS IN 1/2 AMPLITUDE)
R1115       SET3..
R1118           PCARD2 = +9  (NUMBER REVERSALS MINUS 1)
R1117           PCARD5 = +1  (NUMBER OF PULSE BURSTS IN 1/2 AMPLITUDE)
R1118       SET4..
R1119           PCARD3 = +0  (NUMBER REVERSALS MINUS 1)
R1120           PCARD6 = +0  (NUMBER OF PULSE BURSTS IN 1/2 AMPLITUDE)
```

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P1121 STROKE TEST INITIALIZATION PACKAGE (AS A JOB, FROM VERB 68)

```
1122                        17,2213                    BANK   17
1123  REF   2  LAST  922   20,2000                    SETLOC DAPS2
1124                        20,3446                    BANK

1125  REF   1               E6,1665                    COUNT* $$/STRK
1126  REF   2  LAST  103                              EBANK= CADDY

1127  REF   1               20,3446  0 3465 0  STRKTSTI TCR    TSTINIT    STROKE TEST INITIALIZATION PKG (CALLED
A1128                                                                       AS A JOB BY VERB68)

1129                        20,3447  0 0004 0  TVCDTCHK INHINT
1130  REF  10  LAST  936    20,3450  31'635 0            CAE    T5TVCDT    STROKE TEST PERMITTED ONLY WITH 80MS DAP
1131  REF 100  LAST  940    20,3451  54 001 1            TS     L              CHECK CURRENT TIMING
1132  REF   2  LAST  907    20,3452  3 7677 0            CAF    OCT37774   LOOK FOR 80MS (T5)
1133                        20,3453  0 0006 1            EXTEND
1134  REF  10  LAST  184    20,3454  06 001 0            RXOR   LCHAN      +0 IF 80MS
1135  REF 206  LAST  936    20,3455  10 000 0            CCS    A
1136                        20,3456  1 3462 0            TCF    +4             NOT 80MS

1137  REF   6  LAST  906    20,3457  31'412 1            CAE    ESTROKER   80MS. OK, SET STROKER FOR TEST
1138  REF   9  LAST  930    20,3460  55'614 1            TS     STROKER
1139                        20,3461  1 3464 0            TCF    +3

1140  REF 166  LAST  935    20,3462  4 4714 0            CS     ZERO       ENABLE, BUT DO NOT ACTIVATE STROKE
1141  REF  10  LAST  945    20,3463  55'614 1            TS     STROKER        TEST, AWAITING SWITCHOVER
A1142                                                                          TO MODOR (MOD80)
1143  REF 104  LAST  691    20,3464  1 5112 1            TCF    ENDOFJOB
1144  REF   1               20,3465  4 3475 0  TSTINIT  CS     FCADDY     NORMAL ENTRY FROM STRKTSTI
1145  REF   3  LAST  945    20,3466  55'665 1            TS     CADDY
1146  REF   2  LAST  103    20,3467  55'666 1            TS     N              NOTE SGN CHNG FCADDY(+) TO CADDY(-)

1147  REF   1               20,3470  3 3476 1            CAF    PREVS
1148  REF   2  LAST  103    20,3471  55'670 0            TS     REVS

1149  REF   1               20,3472  4 3477 1            CS     FCARD          NOTE SGN CHNG FCARD(+) TO CARD(-)
1150  REF   2  LAST  103    20,3473  55'671 1            TS     CARD

1151  REF 188  LAST  940    20,3474  0 0002 0            TC     Q          RETURN TO STRKTSTI+1  (OR CHKSTR<+2OR+4)
```

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P1152   THE OFFICIAL STROKE TEST WAVEFORM (3 JAN, 1967) CONSISTS OF FOUR STROKE SETS, AS FOLLOWS....

R1154         SET 1...10 BURSTS IN 1/2 AMP,   4 REVERSALS
R1155         SET 2... 6 BURSTS IN 1/2 AMP,   6 REVERSALS
R1156         SET 3... 5 BURSTS IN 1/2 AMP,  10 REVERSALS
R1157         SET 4... 4 BURSTS IN 1/2 AMP,  14 REVERSALS
R1158   THE PULSE BURST SIZE (ESTROKER) IS PAD-LOADED (5 BITS AS OF 3JAN,1967)
R1159   THE REMAINING WAVEFORM-GENERATING PARAMETERS ARE AS FOLLOWS....

 1160                        20,3475   00012 1  FCADDY  DEC    10          NO. PULSE BURSTS IN 1/2 AMP, SET1..(+10)
 1161                        20,3476   00003 1  FREVS   DEC    3           NO. REVERSALS MINUS 1, SET1.....(  3)

 1162                        20,3477   00004 0  FCADD0  DEC    4           NO. STROKE SETS.....(+ 4)

 1163                        20,3500   00005 1  FCADD1  DEC    5           NO. REVERSALS MINUS 1, SET2.....(  5)

 1164                        20,3501   00011 1  FCADD2  DEC    9                                       3.....(  9)
 1165                        20,3502   00015 0  FCADD3  DEC    13                                      4.....( 13)

 1166                        20,3503   00006 1  FCADD4  DEC    6           NO. PULSE BURSTS IN 1/2 AMP, SET2..(+ 6)
 1167                        20,3504   00005 1  FCADD5  DEC    5                                       SET3..(+ 5)
 1168                        20,3505   00004 0  FCADD6  DEC    4                                       SET4..(+ 4)

 1169  REF  37  LAST  916      4711             20MS    =      BIT2
R1170  STROKE TEST PACKAGE PROPER....

 1171  REF   2  LAST  103   E6,1667                     EBANK=  BUNKER

 1172                        20,3506  0 0006 1  HACK    EXTEND
 1173  REF   3  LAST  946   20,3507  23#667 1          QXCH    BUNKER      SAVE Q FOR DAP RETURN

 1174  REF   1               20,3510  3 4711 1          CAF     20MS        2DAPSX2(PASSES/DAP)X2(CS/PASS)=6CS=TVCDT
 1175  REF  45  LAST  918   20,3511  0 5140 1          TC      WAITLIST
 1176  REF   4  LAST  946   E6,1667                     EBANK=  BUNKER
 1177  REF   1               20,3512   03515 0          2CADR   HACKWLST
 1177  REF   1               20,3513   40066 0
 1176                        20,3514  1 3517 0          TCF     +3

 1179  REF   1               20,3515  3 4367 1  HACKWLST CAF     TCTSKOVR    ENTRY FROM WAITLIST
 1180  REF   5  LAST  946   20,3516  55#667 0          TS      BUNKER      BUNKER IS TC TASKOVER

 1161  REF  11  LAST  945   20,3517  3 1614 0          CA      STROKER     STROKE
 1162  REF   5  LAST  926   20,3520  26 054 1          ADS     TVCPITCH

 1183  REF  26  LAST  926   20,3521  3 4700 1          CAF     BIT11       RELEASE THE ERROR COUNTERS
 1184                        20,3522  0 0006 1          EXTEND
 1185  REF  10  LAST  932   20,3523  05 014 1          WOR     CHAN14
 1186  REF   4  LAST  945   20,3524  25#665 0          INCR    CADDY       COUNT DOWN THE NO. BURSTS, THIS SLOPE
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1187  REP  5  LAST  948  20,3525  4 1665 1          CS    CADDY
1188                      20,3526  0 0006 1          EXTEND
1189                      20,3527  6 3531 0          BZMF  +2
1190  REP  6  LAST  946  20,3530  0 1667 1          TC    BUNKER      EXIT, WHILE ON A SLOPE
1191  REP  3  LAST  945  20,3531  11∝670 0          CCS   REVS
1192  REP  1             20,3532  1 3552 1          TCF   REVUP       POSITIVE REVS
1193  REP  2  LAST  947  20,3533  1 3556 0          TCF   REVUP +4    FINAL REVERSAL, THIS SET

1194  REP  3  LAST  945  20,3534  25∝671 0          INCR  CARD        NEGATIVE REVS SET LAST PASS, READY FOR
1195  REP  4  LAST  947  20,3535  4 1671 1          CS    CARD              THE NEXT SET. CHECK IF NO MORE SETS
1196                      20,3536  0 0006 1          EXTEND
1197  REP  1             20,3537  1 3550 0          BZF   STROKILL    ALL SETS COMPLETED

1198  REP  5  LAST  947  20,3540  51∝671 0          INDEX CARD
1199  REP  2  LAST  945  20,3541  3 3503 1          CAF   PCARD +4    PICK UP NO. REVERSALS (-), NEXT SET
1200  REP  4  LAST  947  20,3542  55∝670 0          TS    REVS        REINITIALIZE
1201  REP  6  LAST  947  20,3543  51∝671 0          INDEX CARD
1202  REP  3  LAST  947  20,3544  4 3506 0          CS    PCARD +7    PICK UP NO. BURSTS IN 1/2AMP, NEXT SET
1203  REP  3  LAST  945  20,3545  55∝666 1          TS    N           REINITIALIZE
1204  REP  6  LAST  947  20,3546  55∝665 1          TS    CADDY
1205  REP  7  LAST  947  20,3547  0 1667 1          TC    BUNKER      EXIT, AT END OF SET
1206  REP 12  LAST  946  20,3550  55∝614 1  STROKILL TS    STROKER     RESET (TO +0) TO END TEST
1207  REP  8  LAST  947  20,3551  0 1667 1          TC    BUNKER      EXIT, STROKE TEST FINIS
1208  REP  5  LAST  947  20,3552  55∝670 0  REVUP   TS    REVS        ALL REVERSALS EXCEPT LAST OF SET
1209  REP  4  LAST  947  20,3553  3 1666 0          CA    N
1210                      20,3554  6 0000 1          DOUBLE            2 X 1/2AMP
1211                      20,3555  1 3561 1          TCF   +4

1212  REP 99  LAST  651  20,3556  4 4712 0     +4   CS    ONE         FINAL REVERSAL, THIS SET
1213  REP  6  LAST  947  20,3557  55∝670 0          TS    REVS        PREPARE TO BRANCH TO NEW BURST
1214  REP  5  LAST  947  20,3560  3 1666 0          CA    N           JUST RETURN TO ZERO, FINAL SLOPE OF SET
1215  REP  7  LAST  947  20,3561  55∝665 1          TS    CADDY       CADUP

1216  REP 13  LAST  947  20,3562  4 1614 1          CS    STROKER     CHANGE SIGN OF SLOPE
1217  REP 14  LAST  947  20,3563  55∝614 1          TS    STROKER
1218  REP  9  LAST  947  20,3564  0 1667 1          TC    BUNKER      EXIT AT A REVERSAL (SLOPE CHANGE)
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L TVCROLLDAP USER=S PAGE NO. 1 E0 S3

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R1000   PROGRAM NAME....ROLL AUTOPILOT, CONSISTING OF ROLLDAP,DURATION,NOROLL1,E
R1001   ORIGINAL CODING BY F.W.MARTIN, 1965 (SUNDIAL)                        TC.
R1003   LOG SECTION....ROLL AUTOPILOT   SUBROUTINE....DAPCSM
R1004   MOD BY ENGEL                   DATE 26 DEC, 1967 (SUNDISK TO COLOSSUS)
R1005   FUNCTIONAL DESCRIPTION....

R1006       *AN ADAPTATION OF THE LEM P-AXIS CONTROLLER
R1007       *MAINTAIN OGA WITHIN 5 DEG DEADBND OF OGAD, WHERE OGAD = OGA AS SEEN
R1008        BY IGNOVER  (IGNITION)
R1009       *MAINTAIN OGA RATE LESS THAN 0.1 DEG/SEC LIMIT CYCLE RATE
R1012       *SWITCHING LOGIC IN PHASE PLANE.... SEE GSOP CHAPTER 3
R1013       *USES T6 CLOCK TO TIME JET FIRINGS
R1014       *MAXIMUM JET FIRING TIME = 2.56 SECONDS, LIMITED TO 2.5 IF GREATER
R1015       *MINIMUM JET FIRING TIME = 15 MS
R1016       *JET PAIRS FIRE ALTERNATELY
R1017       *AT LEAST 1/2 SECOND DELAY BEFORE A NEW JET PAIR IS FIRED
R1018       *JET FIRINGS MAY NOT BE EXTENDED, ONLY SHORTENED, WHEN RE-EVALUATION
R1019        OF A JET FIRING TIME IS MADE ON A LATER PASS

R1020   CALLING SEQUENCE....

R1021       *ROLLDAP CALL VIA WAITLIST, IN PARTICULAR BY TVCEXEC (EVERY 1/2 SEC)
R1022        WITH A 3CS DELAY TO ALLOW FREE TIME FOR OTHER RUPTS (DWNRPT, ETC.)

R1023   NORMAL EXIT MODES.... ENDOFJOB

R1024   ALARM OR ABORT EXIT MODES.... NONE

R1025   SUBROUTINES CALLED.....NONE

R1026   OTHER INTERFACES....

R1027       *TVCEXEC SETS UP ROLLDAP TASK EVERY 1/2 SECOND AND UPDATES 1/CONACC
R1028        EVERY 10 SECONDS (VIA MASSPROP AND S40.15)
R1029       *TVCRESTART PACKAGE WILL RE-START ROLL DAP AFTER A RESTART (PICKING
R1030        UP THE ORIGINAL OGAD)

R1032   ERASABLE INITIALIZATION REQUIRED....

R1033       *1/CONACC   (S40.15)
R1034       *OGAD (CDUX, AT IGNOVER)
R1035       *OGANOW  (CDUX AT TVCINIT4 AND TVCEXECUTIVE)
R1036       *OGAPAST  (OGANOW AT TVCEXECUTIVE)
R10362      *ROLLFIRE = TEMREG = ROLLWORD = 0   (MRCLEAN LOOP IN TVCDAPON)
R1037   OUTPUT....

R1038       *ROLL JET PAIR FIRINGS

R1040   DEBRIS.... MISCELLANEOUS, SHAREABLE WITH RCS/ENTRY, IN EBANK6 ONLY
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P1041  SOME NOTES ON THE ROLL AUTOPILOT, AND IN PARTICULAR, ON ITS SWITCHING
R1042  LOGIC.  SEE SECTION THREE OF THE GSOP (SUNDISK/COLOSSUS) FOR DETAILS.
R1043  SWITCHING LOGIC IN THE PHASE PLANE....

R1044                              OGARATE
R1045                                 *
R1046                                 *
R1047   * * * * * * * * * * *         *
R1048                                 *     (REGION 1, SEE TEXT BELOW)
R1049                              *  *  *
R1050                                 *
R1051  * * * * * * *     (COAST)     *     ...PARABOLA (SWITCHING = CONTROL)
R1052              *                  *
R1053                *                *   *
R1054                  *              *                (FIRE NEG ROLL JETS)
R1055                    *            *      *
R1056      (-DB,+LMCRATE)....*        *
R1057                       *         *        *
R1058                       *         *                                OGAERROR
R1059  ********************************************************************************
R1060                                 *         *                    (-AK, OGAERR)
R1061                          *      *         *      (REGION 6-PRIME)
R1062                                 *         *      (SEE TEXT BELOW)
R1063                             *   *         *
R1064                                 *           *      ...STRAIGHT LINE
R1065     (FIRE POS ROLL JETS)     *  *              *
R1066                                 *   (COAST)       *
R1067                                 *                   * * * * * * * * * * *
R1068                                 *                        -MINLIM
R1069                                 *    *
R1070                                 *
R1071                                 *          * * * * * * * * * * * * * * * *
R1072                                 *                        -MAXLIM
R1073                                 *
R1074                                 *

R1075  SWITCHING PARABOLAS ARE CONTROL PARABOLAS, THUS REQUIRING KNOWLEDGE OF
R1076       CONTROL ACCELERATION CONACC, OR ITS RECIPROCAL, 1/CONACC, THE TVC
R1077       ROLL DAP GAIN  (SEE TVCEXECUTIVE VARIABLE GAIN PACKAGE).  JET
R1078       FIRING TIME IS SIMPLY THAT REQUIRED TO ACHIEVE THE DESIRED OGARATE,
R1079       SUBJECT TO THE LIMITATIONS DISCUSSED UNDER FUNCTIONAL DESCRIPTION,
R1080       ABOVE.

R1081  THE THREE CONTROL REGIONS  (+, -, AND ZERO TORQUE) ARE COMPRIZED OF
R1082       TWELVE SUBSET REGIONS  ( 1...6, AND THE CORRESPONDING 1-PRIME...
R1083       6-PRIME ).  SEE SECTION 3 OF THE GSOP  (SUNDISK OR COLOSSUS)
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P1084   GIVEN THE OPERATING POINT NOT IN THE COAST REGION, THE DESIRED OGARATE
R1085         IS AT THE POINT OF PENETRATION OF THE COAST REGION BY THE CONTROL
R1086         PARABOLA WHICH PASSES THROUGH THE OPERATING POINT. FOR REGION 3
R1087         DESIRED OGARATE IS SIMPLY +-MAXLIM. FOR REGIONS 1 OR 8 THE SOLUTION
R1088         TO A QUADRATIC IS REQUIRED (THE PENETRATION IS ALONG THE STRAIGHT
R1089         LINE OR MINLIM BOUNDRY SWITCH LINES). AN APPROXIMATION IS MADE
R1090         INSTEAD. CONSIDER AN OPERATING POINT IN REGION 8. PASS A TANGENT TO
R1091         THE CONTROL PARABOLA THROUGH THE OPERATING POINT, AND FIND ITS
R1092         INTERSECTION WITH THE STRAIGHT LINE SECTION OF THE SWITCH CURVE...
R1093         THE INTERSECTION DEFINES DESIRED OGARATE. IF THE OPERATING POINT IS
R1094         CLOSE TO THE SWITCH LINE, THE APPROXIMATION IS QUITE GOOD (INDEED
R1095         THE APPROXIMATE AND QUADRATIC SOLUTIONS CONVERGE IN THE LIMIT AS
R1096         THE SWITCH LINE IS APPROACHED). IF THE OPERATING POINT IS NOT CLOSE
R1097         TO THE SWITCH LINE, THE APPROXIMATE SOLUTION GIVES VALID TREND
R1098         INFORMATION (DIRECTION OF DESIRED OGARATE) AT LEAST. THE
R1099         RE-EVALUATION OF DESIRED OGARATE IN SUBSEQUENT ROLL DAP PASSES (1/2
R1100         SECOND INTERVALS) WILL BENEFIT FROM THE CONVERGENT NATURE OF THE
R1101         APPROXIMATION.

R11021  FOR LARGE OGAERROR THE TANGENT INTERSECTS +-MINLIM SWITCH BOUNDRY BEFORE
R11022        INTERSECTING THE STRAIGHT LINE SWITCH. HOWEVER THE MINLIM IS
R11023        IGNORED IN COMPUTING THE FIRING TIME, SO THAT THE EXTENSION (INTO
R11024        THE COAST REGION) OF THE STRAIGHT LINE SWITCH IS WHAT IS FIRED TO.
R11025        IF THE ROLL DAP FINDS ITSELF IN THE COAST REGION BEFORE REACHING
R11026        THE DESIRED INTERSECTION (IE, IN THE REGION BETWEEN THE MINLIM
R11027        AND THE STRAIGHT LINE SWITCH) IT WILL EXIBIT NORMAL COAST-REGION
R11028        BEHAVIOR AND TURN OFF THE JETS. THE PURPOSE OF THIS FIRING POLICY
R11029        IS TO MAINTAIN STATIC ROLL STABILITY IN THE EVENT OF A JET
R1103         FAILED-ON.

R1113   WHEN THE OPERATING POINT IS IN REGION 1 THE SAME APPROXIMATION IS
R1114         MADE, BUT AT AN ARTIFICIALLY-CREATED OR DUMMY OPERATING POINT,
R1115         DEFINED BY.. OGAERROR = INTERSECTION OF CONTROL PARABOLA AND
R1116         OGAERROR AXIS, OGARATE = +-LMGRATE WHERE SIGN IS OPPOSITE THAT OF
R1117         REAL OPERATING POINT RATE. WHEN THE OPERATING POINT HAS PASSED
R1118         FROM REGION 1 TO REGION 6, THE DUMMY POINT IS NO LONGER REQUIRED,
R1119         AND THE SOLUTION REVERTS TO THAT OF A REGULAR REGION 8 POINT.
R1120   EQUATION FOR SWITCHING PARABOLA (SEE FIGURE ABOVE)....
R1121                                    2
R1122         SOGAERROR = (DB - (SOGARATE) (1/CONACC)/2) SGN(SOGARATE)
R1123   EQUATION FOR SWITCHING STRAIGHT LINE SEGMENT....

R1124         SOGARATE = -(-SLOPE)(SOGAERROR) - SGN(SOGARATE) INTERCEP

R1125                  WHERE  INTERCEP = DB(-SLOPE) - LMGRATE
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R1126   EQUATION FOR INTERSECTION, CONTROL PARABOLA AND STRAIGHT SWITCH LINE....

R1127       DOGADOT = NUM/DEN, WHERE
R1128                                    2
R1129           NUM = (-SLOPE)(OGARATE) (1/CONACC)
R1130                   +SGN(DELOGA)(-SLOPE)(OGAERROR - SGN(DELOGA)(DB))
R1131                   +LMCRATE

R1132           DEN = (-SLOPE)(OGARATE)(1/CONACC) - SGN(DELOGA)
R1133                                          2
R1134           DELOGA = OGAERROR - (DB - (OGADOT) (1/CONACC)/2)SGN(OGADOT)
R1135   FOR REGIONS 6 AND 6-PRIME  USE ACTUAL OPERATING POINT  (OGA, OGARATE)
R1136        FOR OGAERROR AND OGARATE IN THE INTERSECTION EQUATIONS ABOVE.
R1137        FOR REGIONS 1 AND 1-PRIME  USE DUMMY OPERATING POINT FOR OGAERROR
R1138        AND OGARATE,  WHERE THE DUMMY POINT IS GIVEN BY....
R1139        OGAERROR= DELOGA + DB SGN(OGARATE)
R1140        OGARATE= -LMCRATE SGN(OGARATE)

R1141   NOTE, OGAERROR = OGA - OGAD  USES DUMMY REGISTER  OGA IN ROLL DAP CODING
R1142         ALSO,AT POINT WHERE DOGADOT IS COMPUTED, REGISTER DELOGA IS USED
R1143         AS A DUMMY REGISTER FOR THE OGAERROR IN THE NUM EQUATION ABOVE
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P11432 ROLLDAP CODING....

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 2000   REF   3  LAST  917   16,2000                          SETLOC  DAPROLL
 2001                       16,3313                          BANK
 2002   REF   9  LAST  904   E6,1672                          EBANK=  OGANOW
 2003   REF   1                                               COUNT*  $$/ROLL
 2006   REF  10  LAST  952   16,3313  31=672 0  ROLLDAP      CAE     OGANOW      OGA RATE ESTIMATOR...SIMPLE FIRST-ORDER
 2007                       16,3314  0 0006 1                EXTEND                  DIFFERENCE (SAMPLE TIME = 1/2 SEC)
 2008   REF   3  LAST  904   16,3315  21=673 0                MSU     OGAPAST
 2009                       16,3316  0 0006 1                EXTEND
 2010   REF  34  LAST  906   16,3317  7 4706 0                MP      BIT5
 2011   REF 207  LAST  945   16,3320  22 000 1                LXCH    A
 2012   REF   1               16,3321  55=533 1                TS      OGARATE     SC.AT B-4 REV/SEC

R2017   COMPUTATIONS WHICH FOLLOW USE OGA FOR OGAERR (SAME REGISTER)
R2018   EXAMINE DURATION OF LAST ROLL FIRING IF JETS ARE NOW ON.
 2019   REF   2  LAST  102   16,3322  3 1611 0  DURATION      CA      ROLLFIRE    SAME SGN AS PRESENT TORQ,MAGN=POSMAX
 2020                       16,3323  0 0006 1                EXTEND
 2021                       16,3324  1 3326 1                BZF     +2          ROLL JETS ARE NOW OFF.
 2022   REF   1               16,3325  1 3334 1                TCF     ROLLOGIC    ENTER LOGIC,JETS NOW ON.

 2023   REF   2  LAST  102   16,3326  31=613 1                CAE     TEMREG      EXAMINE LAST FIRING INTERVAL
 2024                       16,3327  0 0006 1                EXTEND              IF POSITIVE, DONT FIRE
 2025   REF   2  LAST  952   16,3330  1 3334 1                BZF     ROLLOGIC    ENTER LOGIC, JETS NOW OFF.

 2026   REF 167  LAST  945   16,3331  3 4714 1                CAF     ZERO        JETS HAVE NOT BEEN OFF FOR 1/2 SEC. WAIT
 2027   REF   3  LAST  952   16,3332  55=613 0                TS      TEMREG      RESET TEMREG
 2028   REF  46  LAST  909   16,3333  1 5213 0  WAIT1/2       TCF     TASKOVER    EXIT ROLL DAP

R2029   COMPUTE DB-(1/2 CONACC) (OGARATE)SQ (1/2 IN THE SCALING)
 2030   REF   2  LAST  952   16,3334  4 1533 1  ROLLOGIC      CS      OGARATE     SCALED AT 2(-4) REV/SEC
 2031                       16,3335  0 0006 1                EXTEND
 2032   REF   4  LAST  910   16,3336  7 1650 1                MP      1/CONACC    SCALED AT 2(+9) SEC SQ /REV
 2033                       16,3337  0 0006 1                EXTEND
 2034   REF   3  LAST  952   16,3340  7 1533 1                MP      OGARATE
 2035   REF   1               16,3341  6 3727 0                AD      DB          SCALED AT 2(+0) REV
 2036   REF   4  LAST  952   16,3342  55=613 0                TS      TEMREG      QUANTITY SCALED AT 2(+0) REV.

R2037   GET SIGN OF OGARATE
 2038   REF   4  LAST  952   16,3343  3 1533 0                CA      OGARATE
 2039                       16,3344  0 0006 1                EXTEND
 2040                       16,3345  6 3350 1                BZMF    +3          LET SGN(0) BE NEGATIVE
 2041   REF  63  LAST  900   16,3346  3 4712 1                CA      BIT1
 2042                       16,3347  1 3351 1                TCF     +2
 2043   REF  64  LAST  952   16,3350  4 4712 0                CS      BIT1
 2044   REF   2  LAST  103   16,3351  55=676 0                TS      SGNRT       + OR - 2(-14)

R2045   CALCULATE DISTANCE FROM SWITCH PARABOLA,DELOGA
 2046                       16,3352  0 0006 1                EXTEND
 2047   REF   5  LAST  952   16,3353  7 1613 0                MP      TEMREG      SGN(OGARATE) TEMREG NOW IN L
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2048  REF 101 LAST 945  16,3354  4 0001 1          CS    L
2049  REF   3 LAST 103  16,3355  6 1674 0          AD    OGA          SCALED AT 2(+0) REV
2050  REF   2 LAST 103  16,3356  55¤677 1 DELOGAC  TS    DELOGA       SC.AT B+0 REV, PLUS TO RIGHT OF C-PARAB
R2051 EXAMINE SGN(DELOGA) AND CREATE CA OR CS INSTR. DEPENDING UPON SIGN.
2052                     16,3357  0 0006 1          EXTEND
2053                     16,3360  6 3363 1          BZMF  +3
2054  REF  11 LAST 666  16,3361  3 4371 0          CAF   PRIO30       =CA  (30000)
2055                     16,3362  1 3364 1          TCF   +2
2056  REF  36 LAST 906  16,3363  3 4674 0          CAF   BIT15        =CS  (40000)
2057  REF   2 LAST 103  16,3364  55¤700 0          TS    I

2058  REF   3 LAST 953  16,3365  51¤700 1          INDEX I            TSET ON  I SGN(OGARATE)
2059  REF   3 LAST 952  16,3366  0 1676 1          0     SGNRT        CA OR CS
2060                     16,3367  4 0000 0          COM
2061                     16,3370  0 0006 1          EXTEND
2062  REF   1           16,3371  6 3442 0 REG1TST  BZMF  ROLLON       IF REGION 1 (DELOGA OGARATE SAME SIGN)

R2063 NO JET FIRE YET. TEST FOR MAX OGARATE
2064  REF   4 LAST 953  16,3372  51¤700 1          INDEX I
2065  REF   5 LAST 952  16,3373  0 1533 0          0     OGARATE      CA OR CS...BOTH MUST BE NEG. HERE
2066  REF   2 LAST 103  16,3374  55¤701 1          TS    IOGARATE     I.E. I OGARATE
2067  REF   1           16,3375  6 3735 0          AD    MAXLIM       SCALED AT 2(-4) REV/SEC
2068                     16,3376  0 0006 1          EXTEND
2069  REF   1           16,3377  6 3521 1 REG3TST  BZMF  RATELIM      IF REGION 3 (RATES TOO HIGH, FIRE JETS)

R2070 COMPUTATION OF I((-SLOPE)OGA + OGARATE) - INTERCEPT. NOTE THAT STR. LINE
R2071 SWITCH SLOPE IS (SLOPE) DEG/SEC/DEG,A NEG. QUANTITY
2072  REF   6 LAST 953  16,3400  3 1533 0          CA    OGARATE
2073                     16,3401  0 0006 1          EXTEND
2074  REF  50 LAST 932  16,3402  7 4675 0          MP    BIT14
2075  REF   6 LAST 952  16,3403  55¤613 0          TS    TEMREG
2076  REF   4 LAST 953  16,3404  3 1674 0          CA    OGA
2077                     16,3405  0 0006 1          EXTEND
2078  REF   1           16,3406  7 3730 1          MP    -SLOPE
2079                     16,3407  20 001 1          DDOUBL
2080                     16,3410  20 001 1          DDOUBL
2081                     16,3411  20 001 1          DDOUBL             (OGA ERROR MUST BE LESS THAN +-225 DEG)
2082  REF   7 LAST 953  16,3412  6 1613 1          AD    TEMREG

2083  REF   5 LAST 953  16,3413  51¤700 1          INDEX I
2084  REF 206 LAST 952  16,3414  0 0000 1          0     A            I((-SLOPE)OGA+OGARATE) AT 2(-3)REV/SEC
2085                     16,3415  4 0000 0          COM
2086  REF   1           16,3416  6 3732 1          AD    INTERCEP     SCALED AT 2(-3) REV.
2087                     16,3417  4 0000 0          COM
2088                     16,3420  0 0006 1          EXTEND
2089  REF   1           16,3421  6 3632 0 REG2TST  BZMF  NOROLL       IF REGION 2 (COAST SIDE OF STRT LINE)

R2090 CHECK TO SEE IF OGARATE IS ABOVE MINLIM
2091  REF   3 LAST 953  16,3422  3 1701 0          CA    IOGARATE     ALWAYS NEGATIVE
2092  REF   1           16,3423  6 3733 0          AD    MINLIM       SCALED AT 2(-4) REV/SEC
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 2093                          16,3424  0 0006 1          EXTEND
 2094  REP   2 LAST  953      16,3425  6 3632 0  REG4TST BZMF   NOROLL          IF REGION 4 (COAST SIDE OF MINLIM)

R2095  ALL AREAS CHECKED EXCEPT LAST AREA...NO FIRE IN THIS SMALL SEGMENT
 2096  REP   6 LAST  953      16,3426  51"700 1          INDEX  I
 2097  REP   5 LAST  953      16,3427  0 1674 0          0      OGA
 2098                          16,3430  4 0000 0          COM
 2099  REP   2 LAST  952      16,3431  6 3727 0          AD     DB
 2100                          16,3432  4 0000 0          COM
 2101                          16,3433  0 0006 1          EXTEND
 2102  REP   3 LAST  954      16,3434  6 3632 0  REG5TST BZMF   NOROLL          IF REGION 5 (COAST SIDE OF DB)
R2103  JETS MUST FIRE NOW.OGARATE IS NEG.(OR VISA VERSA).USE DIRECT STR. LINE.
R2104  DELOGA AND DELOGART ARE USED AS DUMMY VARIABLES IN THE SOLUTION OF A
R2105  STRAIGHT LINE APPROXIMATION TO A QUADRATIC SOLUTION OF THE INTERSECTION
R2106  OF THE CONTROL PARABOLA AND THE STRAIGHT-LINE SWITCH LINE. THE STRAIGHT
R2107  LINE IS THE TANGENT TO THE CONTROL PARABOLA AT THE OPERATING POINT. (FOR
R2108  OPERATING POINTS IN REGIONS  6 AND 6-PRIME)
 2109  REP   6 LAST  954      16,3435  31"674 0  REGION6 CAE    OGA            USE ACTUAL OPERATING POINT FOR TANGENT
 2110  REP   3 LAST  953      16,3436  55"677 1          TS     DELOGA         ACTUAL STATE
 2111  REP   7 LAST  953      16,3437  3 1533 0          CA     OGARATE
 2112  REP   2 LAST  103      16,3440  55"675 0          TS     DELOGART       ACTUAL STATE,I.E. DEL OGARATE
 2113  REP   1                16,3441  1 3451 0          TCF    ONROLL

R2114  JETS ALSO FIRE FROM HERE EXCEPT OGARATE IS POS(VISA VERSA),USE INDIRECT
R2115  STRAIGHT LINE ESTABLISHED BY TANGENT TO A CONTROL PARABOLA AT  ((DELOGA
R2116  + DB SGN(DELOGA) ), -LMCRATE SGN(DELOGA) )        (THIS IS THE DUMMY
R2117  OPERATING POINT FOR OPERATING POINTS IN REGIONS 1 AND 1-PRIME )
 2118  REP   7 LAST  954      16,3442  51"700 1  ROLLON  INDEX  I
 2119  REP   3 LAST  954      16,3443  0 3727 0          0      DB
 2120  REP   4 LAST  954      16,3444  27"677 1          ADS    DELOGA         DELOGA WAS DIST. FROM SWITCH PARABOLA

 2121  REP   1                16,3445  4 3731 0          CS     LMCRATE        LIMIT CYCLE RATE AT 2(-4) REV/SEC
 2122  REP   6 LAST  954      16,3446  51"700 1          INDEX  I
 2123  REP 209 LAST  953      16,3447  0 0000 1          0      A
 2124  REP   3 LAST  954      16,3450  55"675 0          TS     DELOGART       EVALUATE STATE FOR INDIRECT LINE.

R2125  SOLVE STRAIGHT LINES SIMULTANEOUSLY TO OBTAIN DESIRED OGARATE.
 2126                          16,3451  0 0006 1  ONROLL  EXTEND               DELOGART IN ACC. ON ARRIVAL
 2127  REP   5 LAST  952      16,3452  7 1650 1          MP     1/CONACC
 2128                          16,3453  6 0000 1          DOUBLE
 2129                          16,3454  0 0006 1          EXTEND
 2130  REP   2 LAST  953      16,3455  7 3730 1          MP     -SLOPE
 2131  REP   6 LAST  953      16,3456  55"613 0          TS     TEMREG         2(-SLOPE)RATE /CONACC
 2132                          16,3457  0 0006 1          EXTEND
 2133  REP   4 LAST  954      16,3460  7 1675 0          MP     DELOGART
 2134  REP   5 LAST  954      16,3461  55"675 0          TS     DELOGART       2(-SLOPE)(RATESQ)/CONACC
 2135  REP  27 LAST  946      16,3462  4 4700 0          CS     BIT11
 2136  REP   9 LAST  954      16,3463  51"700 1          INDEX  I
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2137   REF 210  LAST  954   16,3464  0 0000 1            0        A
2138   REF   9  LAST  954   16,3465  27'613 0  RATEDEN   ADS      TEMREG      DENOMINATOR COMPLETED

2139   REF  10  LAST  954   16,3466  51'700 1            INDEX    I
2140   REF   5  LAST  954   16,3467  0 1677 0            0        DELOGA
2141                        16,3470  4 0000 0            COM
2142   REF   4  LAST  954   16,3471  6 3727 0            AD       DB
2143                        16,3472  4 0000 0            COM
2144                        16,3473  0 0008 1            EXTEND
2145   REF   3  LAST  954   16,3474  7 3730 1            MP       -SLOPE
2146   REF   6  LAST  954   16,3475  27'675 0            ADS      DELOGART
2147   REF   2  LAST  954   16,3476  3 3731 1            CA       LMCRATE
2148                        16,3477  0 0006 1            EXTEND
2149   REF  28  LAST  954   16,3500  7 4700 0            MP       BIT11
2150   REF   7  LAST  955   16,3501  6 1875 1  RATENUM   AD       DELOGART    NUMERATOR COMPLETED

2151   REF 102  LAST  953   16,3502  56 001 0            XCH      L           PLACE NUMERATOR IN L FOR OVERFL. CHECK
2152   REF 168  LAST  952   16,3503  3 4714 1            CA       ZERO
2153                        16,3504  0 0006 1            EXTEND
2154   REF  10  LAST  955   16,3505  11'613 0            DV       TEMREG      OVERFLOW, IF ANYTHING, NOW APPEARS IN A
2155                        16,3506  0 0006 1            EXTEND
2156   REF   1              16,3507  1 3515 1            BZF      DVOK        NO OVERFLOW....(0,L)/TEMREG = 0,L

2157   REF 211  LAST  955   16,3510  10 000 0  MINLIMAP  CCS      A
2158   REF  19  LAST  900   16,3511  3 4672 0            CAP      POSMAX          POSITIVE OVERFLOW
2159   REF   1              18,3512  1 3524 0            TCF      ROLLSET
2160   REF  20  LAST  955   16,3513  4 4672 1            CS       POSMAX          NEGATIVE OVERFLOW
2161   REF   2  LAST  955   16,3514  1 3524 0            TCF      ROLLSET

2162   REF 212  LAST  955   16,3515  22 000 1  DVOK      LXCH     A           PUT NUMERATOR BACK INTO A, 0 IN L
2163                        16,3516  0 0006 1            EXTEND
2164   REF  11  LAST  955   16,3517  11'613 0            DV       TEMREG      RESULT OF DIVISION IS DESIRED OGARATE
2165   REF   3  LAST  955   16,3520  1 3524 0            TCF      ROLLSET         ( SCALED AT B-4 REV/SEC )
2173   REF   2  LAST  953   16,3521  4 3735 1  RATELIM   CS       MAXLIM
2174   REF  11  LAST  955   16,3522  51'700 1            INDEX    I
2175   REF 213  LAST  955   16,3523  0 0000 1            0        A           IF I = CA, DESIRED RATE IS   -MAXLIM

R2176  BASED ON DESIRED RATE - PRESENT RATE,COMPUTE JET FIRE TIME
2177   REF  12  LAST  955   16,3524  55'613 0  ROLLSET   TS       TEMREG      STORE DESIRED OGARATE (SCALED B-4)
21771                       16,3525  0 0006 1            EXTEND
2178   REF   8  LAST  954   16,3526  61'533 0            SU       OGARATE     RATE DIFF. SCALED AT 2(-4) REV/SEC
21781  REF  13  LAST  955   16,3527  55'613 0            TS       TEMREG          OVERFLOW PROTECT
21782                       16,3530  1 3533 0            TCF      +3                  B       B
217821 REF 214  LAST  955   16,3531  50 000 1            INDEX    A                   B       B
217822 REF   2  LAST  842   16,3532  4 4673 0            CS       LIMITS              B       B
2179                        16,3533  0 0006 1            EXTEND
2180   REF   1              16,3534  7 7665 1            MP       T6SCALE     T6SCALE = 8/10.24
2181                        16,3535  0 0006 1            EXTEND
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2162  REF   6  LAST  954   16,3536  7 1650 1            MP      1/CONACC     SCALED AT 2(+9) SECSQ/REV.
2163                       16,3537  20 001 1            DDOUBL
21831                      16,3540  20 001 1            DDOUBL
2184  REF  14  LAST  955   16,3541  55=613 0            TS      TEMREG
21641                      16,3542  1 3545 1            TCF     +3           OVERFLOW PROTECT
21642 REF 215  LAST  955   16,3543  50 000 1            INDEX   A              #      #
21643 REF   3  LAST  955   16,3544  4 4673 0            CS      LIMITS         #      #
2165  REF  15  LAST  956   16,3545  55=613 0            TS      TEMREG         #      #
2166                       16,3546  0 0006 1            EXTEND       JET FIRE TIME AT 625 MICROSEC/BIT
2167  REF   4  LAST  954   16,3547  1 3632 1            BZF     NOROLL       POS MEANS POSITIVE ROLL TORQUE.

R2186 JET FIRE TIME IS NZ, ARE JETS ON NOW.
21681 REF  16  LAST  956   16,3550  31=613 1            CAE     TEMREG       DESIRED CHANGE IN OGARATE
2189                       16,3551  0 0006 1            EXTEND
2190  REF   3  LAST  952   16,3552  7 1611 1            MP      ROLLFIRE     (SGN OF TORQUE..ZERO IF JETS NOW OFF)
2191  REF 216  LAST  956   16,3553  10 000 0            CCS     A
2192  REF   1               16,3554  1 3560 0            TCF     MOREROLL     CONTINUE FIRING WITH PRESENT POLARITY
2193  REF   1               16,3555  1 3563 0            TCF     NEWROLL      START NEW FIRING NOW, PLUS
2194  REF   5  LAST  956   16,3556  1 3632 1            TCF     NOROLL       TERMINATE OLD FIRING, NEW SIGN REQUESTED
2195  REF   2  LAST  956   16,3557  1 3563 0            TCF     NEWROLL      START NEW FIRING NOW, MINUS

R2196 CONTINUE PRESENT FIRING
2197  REF 169  LAST  955   16,3560  3 4714 1  MOREROLL  CAF     ZERO
2198  REF  12  LAST  955   16,3561  55=700 0            TS      I            USE TEMP. AS MOREROLL SWITCH
2199  REF   1               16,3562  1 3574 0            TCF     MAXTFIRE

R2200 START NEW FIRING BUT CHECK IF GREATER THAN MINIMUM FIRE TIME.
2201  REF  17  LAST  956   16,3563  11=613 0  NEWROLL   CCS     TEMREG       CALL THIS T6FIRE
2202  REF 100  LAST  947   16,3564  6 4712 1            AD      ONE
2203                       16,3565  1 3567 1            TCF     +2
2204  REF 101  LAST  956   16,3566  6 4712 1            AD      ONE
2205                       16,3567  4 0000 0            COM          -MAG(T6FIRE)
2206  REF   1               16,3570  6 3736 0            AD      TMINFIRE     TMINFIRE-MAG(T6FIRE)
2207                       16,3571  4 0000 0            COM
2206                       16,3572  0 0006 1            EXTEND
2209  REF   6  LAST  956   16,3573  6 3632 0  MINTST    BZMF    NOROLL       IF NOT GREATER THAN TMINFIRE (NEW FIRE)

R2210 PROCEED WITH NEW FIRING BUT NOT LONGER THAN TMAXFIRE
2211  REF  18  LAST  956   16,3574  3 1613 1  MAXTFIRE  CA      TEMREG
2212                       16,3575  0 0006 1            EXTEND
2213  REF   1               16,3576  7 4710 1            MP      1/TMXFIR     I.E. 1/TMAXFIRE
2214                       16,3577  0 0006 1            EXTEND
2215  REF   1               16,3600  1 3606 0  MAXTST    BZF     NOMXFIRE     IF LESS THAN TMAXFIRE

2216  REF 217  LAST  956   16,3601  10 000 0            CCS     A
2217  REF   1               16,3602  3 3737 1            CAF     TMAXFIRE     USE MAXIMUM
2218                       16,3603  1 3605 0            TCF     +2
2219  REF   2  LAST  956   16,3604  4 3737 0            CS      TMAXFIRE     USE MAXIMUM
2220  REF  19  LAST  956   16,3605  55=613 0            TS      TEMREG
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R2221   SET UP SIGN OF REQUIRED TORQUE
 2222   REF  20  LAST  956   16,3606  11=613 0  NOMXFIRE CCS   TEMREG     FOR TORQUE SIGN
 2223   REF  21  LAST  955   16,3607  3 4672 0           CA    POSMAX     POSITIVE TORQUE REQUIRED
 2224                        16,3610  1 3612 0           TCF   +2
 2225   REF   4  LAST  938   16,3611  3 4674 0           CA    NEGMAX     NEGATIVE TORQUE REQUIRED
 2226   REF   4  LAST  956   16,3612  55=611 1           TS    ROLLFIRE   SET ROLLFIRE FOR + OR - TORQUE

 2227                        16,3613  4 0000 0           COM              COMPLEMENT... POS. FOR NEG. TORQUE
 2228                        16,3614  0 0006 1           EXTEND
 2229                        16,3615  6 3620 0           BZMF  +3         POSITIVE TORQUE REQUIRED
 2230   REF  21  LAST  957   16,3616  4 1613 0           CS    TEMREG
 2231   REF  22  LAST  957   16,3617  55=613 0           TS    TEMREG

 2232   REF  13  LAST  956   16,3620  3 1700 1  FIRELOOK CA    I          IS IT MOREROLL
 2233                        16,3621  0 0006 1           EXTEND
 2234   REF   1              16,3622  1 3624 0           BZF   FIREPLUG   YES
 2235   REF   1              16,3623  1 3635 0           TCF   JETROLL    MAG(T6FIRE) NOW IN TEMREG

 2236   REF   1              16,3624  30 031 0  FIREPLUG CAE   TIME6      CHECK FOR EXTENDED FIRING
 2237                        16,3625  0 0006 1           EXTEND
 2238   REF  23  LAST  957   16,3626  61=613 1           SU    TEMREG
 2241                        16,3627  0 0006 1           EXTEND
 2242   REF  47  LAST  952   16,3630  6 5213 1  EXTENTST BZMF  TASKOVER   IF EXTENSION WANTED, DONT, EXIT ROLL DAP
 2243   REF   2  LAST  957   16,3631  1 3635 0           TCF   JETROLL

 2244   REF 170  LAST  956   16,3632  4 4714 0  NOROLL   CS    ZERO       COAST....(NEG ZERO FOR TIME6)
 2245   REF   5  LAST  957   16,3633  55=611 1           TS    ROLLFIRE   NOTE, JETS CAN FIRE NEXT PASS
 2246   REF  24  LAST  957   16,3634  55=613 0           TS    TEMREG

 2247                        16,3635  0 0006 1  JETROLL  EXTEND
 2248   REF   1              16,3636  3 3726 1           DCA   NOROL1T6
 2249   REF   2  LAST  127   16,3637  53=311 1           DXCH  T6LOC
 2250   REF  25  LAST  957   16,3640  3 1613 1           CA    TEMREG     ENTER JET FIRING TIME
 2251   REF   2  LAST  957   16,3641  54 031 1           TS    TIME6

 2252   REF  14  LAST  957   16,3642  3 1700 1           CA    I          I=0 IF MOREROLL,KEEP SAME JETS ON
 2253                        16,3643  0 0006 1           EXTEND
 2254   REF  48  LAST  957   16,3644  1 5213 0  SAMEJETS BZF   TASKOVER   IF JETS ON KEEP SAME JETS. EXIT ROLL DAP

 2255   REF   6  LAST  957   16,3645  11=611 1           CCS   ROLLFIRE
 2256   REF   1              16,3646  1 3652 1           TCF   +TORQUE
 2257   REF   1              16,3647  1 3713 0           TCF   T6ENABL
 2258   REF   1              16,3650  1 3673 1           TCF   -TORQUE
 2259   REF   2  LAST  957   16,3651  1 3713 0           TCF   T6ENABL

R2260   PROCEED WITH + TORQUE
 2261   REF   2  LAST  102   16,3652  3 1612 0  +TORQUE  CA    ROLLWORD    WHAT WAS THE LAST +TORQUE COMBINATION
 2262   REF  65  LAST  952   16,3653  7 4712 0           MASK  BIT1       WAS IT NO.9-11
 2263                        16,3654  0 0006 1           EXTEND
 2264   REF   1              16,3655  1 3665 0           BZF   NO.9-11    NOT 9-11, SO USE IT THIS TIME
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2265  REF  66  LAST  957   16,3656  4 4712 0  NO.13-15  CS     BIT1
2266  REF   3  LAST  957   16,3657  7 1612 1            MASK   ROLLWORD
2267  REF   4  LAST  956   16,3660  55∝612 1            TS     ROLLWORD     CHANGE BIT 1 TO ZERO
2268  REF   1               16,3661  3 4732 0            CAF    +ROLL2
2269                        16,3662  0 0006 1            EXTEND
2270  REF   2  LAST  179   16,3663  01 006 0            WRITE  CHAN6
2271  REF   3  LAST  957   16,3664  1 3713 0            TCF    T6ENABL

2272  REF  67  LAST  958   16,3665  3 4712 1  NO.9-11   CAF    BIT1         1ST + JETS TO FIRE (MRCLEAN OS ROLLWORD)
2273  REF   5  LAST  956   16,3666  27∝612 1            ADS    ROLLWORD     CHANGE BIT 1 TO ONE
2274  REF   1               16,3667  3 4715 0            CAF    +ROLL1
2275                        16,3670  0 0006 1            EXTEND
2276  REF   3  LAST  956   16,3671  01 006 0            WRITE  CHAN6
2277  REF   4  LAST  956   16,3672  1 3713 0            TCF    T6ENABL

2278  REF   6  LAST  956   16,3673  3 1612 0  -TORQUE   CA     ROLLWORD     WHAT WAS LAST -TORQUE COMBINATION
2279  REF  38  LAST  946   16,3674  7 4711 0            MASK   BIT2         WAS IT NO.12-10
2280                        16,3675  0 0006 1            EXTEND
2281  REF   1               16,3676  1 3706 1            BZF    NO.12-10     NOT 12-10, SO USE IT THIS TIME

2282  REF  39  LAST  956   16,3677  4 4711 0  NO.16-14  CS     BIT2
2283  REF   7  LAST  956   16,3700  7 1612 1            MASK   ROLLWORD
2284  REF   6  LAST  956   16,3701  55∝612 1            TS     ROLLWORD     CHANGE BIT 2 TO ZERO
2285  REF   1               16,3702  3 3740 1            CAF    -ROLL2
2286                        16,3703  0 0006 1            EXTEND
2287  REF   4  LAST  956   16,3704  01 006 0            WRITE  CHAN6
2288  REF   5  LAST  956   16,3705  1 3713 0            TCF    T6ENABL

2289  REF  40  LAST  956   16,3706  3 4711 1  NO.12-10  CAF    BIT2         1ST -JETS TO FIRE (MRCLEAN OS ROLLWORD)
2290  REF   9  LAST  956   16,3707  27∝612 1            ADS    ROLLWORD     CHANGE BIT 2 TO ONE
2291  REF   1               16,3710  3 4377 0            CAF    -ROLL1
2292                        16,3711  0 0006 1            EXTEND
2293  REF   5  LAST  956   16,3712  01 006 0            WRITE  CHAN6

2294  REF  39  LAST  953   16,3713  3 4674 0  T6ENABL   CAF    BIT15
2295                        16,3714  0 0006 1            EXTEND
2296  REF   6  LAST  577   16,3715  05 013 0            WOR    CHAN13
2297  REF  49  LAST  957   16,3716  1 5213 0  RDAPEND   TCF    TASKOVER     EXIT ROLL DAP
```

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```
P2298   THIS T6 TASK SHUTS OFF ALL ROLL JETS
 2299   REF  15  LAST  938    16,3717   22 016 0  NOROLL1  LXCH   BANKRUPT      SHUT OFF ALL (ROLL) JETS, (A T6 TASK
 2300   REF 171  LAST  957    16,3720   3 4714 1           CAP    ZERO             CALLED BY ..JETROLL..)
 2301   REF   7  LAST  957    16,3721   55=611 1           TS     ROLLFIRE      ZERO INDICATES JETS NOW OFF
 2302                         16,3722   0 0006 1           EXTEND
 2303   REF   6  LAST  956    16,3723   01 006 0  KILLJETS WRITE  CHAN6
 2304   REF   4  LAST  938    16,3724   1 5224 1           TCF    NOQRSM
```

P2305 CONSTANTS FOR ROLL AUTOPILOT....

```
2306  REF  11  LAST  923   E6,1742                          EBANK= BZERO
2307  REF   1             16,3725   03717 0  NOROLL1T6  2CADR  NOROLL1
2307  REF   1             16,3726   34088 0

2309                      16,3727   00344 1  DB         DEC   .01388889      DEAD BAND (5 DEG), SC.AT B+0 REV

2310                      16,3730   06315 0  -SLOPE     DEC   0.2            -SWITCHLINE SLOPE(0.2 PER SEC) SC.AT B+0
A2311                                                                          PER SEC
2312                      16,3731   00111 0  LMCRATE    DEC   .00027778 B+4  LIMIT CYCLE RATE (0.1 DEG/SEC) SC.AT
A2313                                                                          B-4 REV/SEC
2314                      16,3732   00510 0  INTERCEP   DEC   .0025 B+3      DB(-SLOPE) - LMCRATE, SC.AT B-3 REV/SC

2315                      16,3733   01330 0  MINLIM     DEC   .00277778 B+4  RATELIM,MIN (1DEG/SEC), SC.AT B-4 REV/SC

2316                      16,3734   00027 1  1/MINLIM   DEC   360 B-18       RECIPROCAL THEREOF, SHIFTED 14 RIGHT

2317                      16,3735   07071 0  MAXLIM     DEC   .01388889 B+4  RATELIM,MAX (5DEG/SEC), SC.AT B-4 REV/SC

2318                      16,3736   00030 1  TMINFIRE   DEC   1.5 B+4        15 MS (14 MIN), SC.AT 18 BITS/CS

2319                      16,3737   07640 1  TMAXFIRE   DEC   250 B+4        2.5 SEC, SC.AT 16 BITS/CS

2320  REF  28  LAST  941     4710            1/TMXFIR   =     BIT3           RECIPROCAL THEREOF, SHIFTED 14 RIGHT,
A23201                                                                         ROUNDS TO OCT00004, SO ALLOWS 2.58
A23202                                                                         SEC FIRINGS BEFORE APPLYING LIMIT
23203 REF   4  LAST  787     7885            T6SCALE    =     PRIO31         (B+3) (16BITS/CS) (100CS/SEC)

2321  REF  23  LAST  908     4715            +ROLL1     =     FIVE           ONBITS FOR JETS 9 AND 11
2322  REF   2  LAST  197     4732            +ROLL2     =     OCT120         ONBITS FOR JETS 13 AND 15
2323  REF   5  LAST  845     4377            -ROLL1     =     TEN            ONBITS FOR JETS 12 NAD 10
2324                      16,3740   00240 1  -ROLL2     OCT   240            ONBITS FOR JETS 16 AND 14
```

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R1000 PROGRAM NAME.... GEN3DAP FILTERS, CONSISTING OF NP0NODE, NP1NODE, NY0NODE, NY1NODE, ETC.
R1002 LOG SECTION.... GEN3DAP FILTERS SUBROUTINE....DAPCSM
R1003 MOD BY ENGEL 20 OCT, 1967

R1004 FUNCTIONAL DESCRIPTION....

R1005 THE GEN3DAP FILTER PACKAGE IS DESIGNED TO PROVIDE FLEXIBLE, LAST-MINUTE CHANGEABLE DIGITAL AUTOPILOT
R1007 FILTERS FOR LEM-OFF FLIGHT. GROUNDRULES FOR THE DESIGN AND USE OF THE PACKAGE ARE AS FOLLOWS.....

R1009 1. FILTER COEFFICIENTS AND GAINS IN ERASABLE MEMORY
R1011 2. UP TO THIRD-ORDER NUMERATOR OR DENOMINATOR
R1013 3. OPERATIONAL FIT WITHIN THE STRUCTURE OF THE REGULAR LEM-CM DAP CODING
R1015 4. DENOMINATOR POLES INSIDE THE Z-PLANE UNIT CIRCLE
R1017 5. NUMERATOR ZEROS INSIDE THE Z-PLANE DOUBLE-UNIT CIRCLE
R1019 6. HIGH FREQUENCY (BODE) GAIN LESS THAN 8ASCREVS, OR 8.8380088 DEG/DEG

R1021 THE FILTERS ARE SHOWN IN THE FOLLOWING DIAGRAMS.....
R1023 PITCH GEN3DAP FILTER..

R1025 KPGEN3
R1027
R1029
R1031
R1033
R1035 EP = ERRBTMP NPO NPD = CMDTMP
R1037
R1039
R1041
R1043
R1045
R1047 YAW GEN3DAP FILTER..

R1049 KYGEN3
R1051
R1053
R1055
R1057
R1059 EY = ERRBTMP NY0 NYP = CMDTMP
R1061
R1063
R1065
R1067
R1069

P1071 THE IMPLEMENTING EQUATIONS FOR THESE FILTERS ARE AS FOLLOWS.....

	PITCH GEN3DAP....	YAW GEN3DAP....
R1073		
R1075	$NPD = (B_{+4})\ KPGEN_3\ NP0$	$NYD = (B_{+4})\ KYGEN_3\ NY0$
R1077	$NP0 = AP0\ EP \quad +4(Z-1)\ NP1$	$NY0 = AY0\ EY \quad +4(Z-1)\ NY1$
R1079	$NY1 = AP1\ EP - BP1\ NP0 + (Z-1)\ NP2$	$NY1 = AY1\ EY - BY1\ NY0 + (Z-1)\ NY2$
R1081	$NP2 = AP2\ EP - BP2\ NP0 + (Z-1)\ NP3$	$NY2 = AY2\ EY - BY2\ NY0 + (Z-1)\ NY3$
R1083	$NP3 = AP3\ EP - BP3\ NP0$	$NY3 = AY3\ EY - BY3\ NY0$

R1085 FILTER INPUTS EP AND EY ARE PICKED UP FROM REGULAR LEM-ON CODING AT ERRBTMP (UPPER WORD ONLY), THUS ARE
R1087 SINGLE PRECISION QUANTITIES SCALED AT B-1 REVS. FILTER OUTPUTS NPD AND NYD ARE LEFT IN DOUBLE PRECISION AT
R1089 CMDTMP, SCALED AT 1 ASCREV, READY FOR OUTPUT PROCESSING VIA REGULAR LEM-ON CODING AT ..P,YOFFSET..
R1091 FOLLOWING OUTPUT PROCESSING, RETURN TO THE GEN3DAP FILTERS IS MADE FOR CALCULATION OF THE REMAINING NODES
R1093 $NP1$ TO $NP3$, OR $NY1$ TO $NY3$. GEN3DAP FILTERS THEN RETURN TO THE LEM-ON CODING AT ..DELBARP,Y.. FOR RESPECTIVE
R1095 OFFSET-TRACKER-FILTER COMPUTATIONS AND COPYCYCLES. NOTE THE EQUIVALENCES...NP1TMP=J5TMP, NP1=J5,
R1097 NP2TMP=NSUMTMP, NP2=PNSUM, NP3TMP=DSUMTMP, NP3=PDSUM, WITH CORRESPONDING RELATIONS FOR YAW. THUS THE COPY-
R1099 CYCLE PCOPY, FROM THE GEN3DAP STANDPOINT, IS EFFECTIVE FROM PMISC-3 TO ITS END AT TC 0. YCOPY FROM YMISC-3.
R1101 SCALING OF THE FILTER NODES, COEFFICIENTS, AND GAINS WITHIN THE AGC IS AS FOLLOWS.....

	QUANTITY	QUANTITY	PHYS.UNITS	MAX.VALUE	SCALE AT (FOR)	
R1103						
R1105	EP	EY	REVS	1/8	B-1 REV	(CDU SCALING)
R1107	NP0	NY0	REVS	(B_{+1})	B_{+1} REV	
R1109	NP1	NY1	REVS	(B_{+3})	B_{+3} REV	
R1111	NP2	NY2	REVS	(B_{+3})	B_{+3} REV	
R1113	NP3	NY3	REVS	(B_{+3})	B_{+3} REV	
R1115	NPD	NYD	ASC REVS	(1)	1 ASCREV	(ACTUATOR CDU SCALING)
R1117	$KPGEN_3$	$KYGEN_3$	ASCREV/REV	(8)	B_{+3} ASCREV/REV	
R1119	AP0	AY0	DIMLESS.	1	B_{+2}	
R1121	AP1	AY1	DIMLESS.	8	B_{+4}	
R1123	AP2	AY2	DIMLESS.	12	B_{+4}	
R1125	AP3	AY3	DIMLESS.	6	B_{+4}	
R1127	BP1	BY1	DIMLESS.	3	B_{+2}	
R1129	BP2	BY2	DIMLESS.	3	B_{+2}	
R1131	BP3	BY3	DIMLESS.	1	B_{+2}	

R1132 FILTER COEFFICIENTS, GAINS, AND NODES ARE HELD IN DOUBLE PRECISION (ERASABLE) TO PERMIT CONSERVATIVE
R1134 SCALING AND YET OFFSET TRUNCATION LOSSES. THIS APPEARS NECESSARY IF FILTER FLEXIBILITY IS TO BE MAINTAINED.
R1136 COMPUTATION TIME IS NOT CRITICAL.

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R1138   CALLING SEQUENCE....

R1139       *TC POSTJUMP....
R1140        CADR NP0NODE, NP1, NY0, NY1.  SPECIFICALLY, FROM PITCHDAP OR YAWDAP
R1141        (TVCDAP),AT P1FILJMP, P2FILJMP, Y1FILJMP, Y2FILJMP

R1142   NORMAL EXIT MODE....

R1143       *TC POSTJUMP....
R1144        CADR  (POFFSET, DELBARP), (YOFFSET, DELBARY).     IE, RETURNS TO
R1145        PITCHDAP OR YAWDAP AT APPROPRIATE ENTRY POINT

R1146   ALARM OR ABORT EXIT MODES....NONE

R1147   SUBROUTINES CALLED.... NONE

R1148   ERASABLE INITIALIZATION REQUIRED....

R1149       *AP0(SP),AP1(DP),...AP3(DP), (PITCH AND YAW) NUMERATOR COEFFICIENTS
R1150        (PAD LOADS)
R1151       *BP1(DP),...BP3(DP), (PITCH AND YAW) DENOMINATOR COEFFICIENTS
R1152        (PAD LOADS)
R1153       *KPGEN3 (S40.15 OF R03)

R1154   OUTPUT....

R1155       *CMDIMP (NPD, NYD) FOR OUTPUT PROCESSING BY PITCHDAP OR YAWDAP
R1156       *OTHER FILTER NODES

R1157   DEBRIS....TVC TEMPORARIES, SHAREABLE WITH RCS/ENTRY IN EBANK6 ONLY
 1158                          21,2026                 BANK   21
 1159   REF   1                17,2000                 SETLOC DAPS4
 1160                          17,2213                 BANK
 1161   REF   1                E6,1742                 EBANK= EP
 1162   REF   1                                        COUNT* $$/GEN3
```

P1163 PITCH GEN3DAP FILTER.....

```
1164                          17,2213  0 0006 1  NP0NODE  EXTEND          FORM NODE NP0....COLLECT. (PAST NP1)
1165  REP   1                17,2214  3 1564 1            DCA     NP1       (COMES HERE FROM REG. DAP CODING)
1166                          17,2215  20 001 1            DDOUBL
1167                          17,2216  20 001 1            DDOUBL
1168  REP   1                17,2217  53=562 0            DXCH    NP0

1169  REP   2  LAST  963      17,2220  31=742 1  AP0(EP)   CAE     EP        SPXSP MULTIPLY FOR NUMERATOR COMPONENT
1170                          17,2221  0 0006 1            EXTEND              EP = ERRBTMP,  SP, SC.AT B-1 REVS
1171  REP   2  LAST   99      17,2222  7 1427 0            MP      AP0
1172  REP   2  LAST  964      17,2223  21=562 0            DAS     NP0       COMPLETED NODE NP0, SC.AT B+1 REVS
1173  REP   3  LAST  964      17,2224  31=561 1  NPDNODE   CAE     NP0       FORM NODE NPD....SPXDP MULTIPLY BY GAIN
1174                          17,2225  0 0006 1            EXTEND
1175  REP   2  LAST  104      17,2226  7 1651 0            MP      KPGEN3
1176  REP   1                17,2227  53=745 1            DXCH    NPD
1177  REP   4  LAST  964      17,2230  31=562 1            CAE     NP0 +1
1178                          17,2231  0 0006 1            EXTEND
1179  REP   3  LAST  964      17,2232  7 1651 0            MP      KPGEN3
1180                          17,2233  22 007 0            ZL
1181  REP 218  LAST  956      17,2234  22 000 1            LXCH    A
1182  REP   2  LAST  964      17,2235  21=745 1            DAS     NPD       SC.AT B+4 ASCREV SINCE KPGEN3 AT B+3

1183  REP   3  LAST  964      17,2236  53=745 1            DXCH    NPD       FIX UP SCALING
1184                          17,2237  20 001 1            DDOUBL
1185                          17,2240  20 001 1            DDOUBL
1186                          17,2241  20 001 1            DDOUBL
1187                          17,2242  20 001 1            DDOUBL
1188  REP   4  LAST  964      17,2243  53=745 1            DXCH    NPD       COMPLETED NODE NPD, SC.AT 1ASCREV
1189  REP  54  LAST  932      17,2244  0 4574 0            TC      POSTJUMP  TRANSFER BACK TO REGULAR DAP CODING FOR
1190  REP   1                17,2245   40441 1            CADR    POFFSET     OUTPUT  (NPD = CMDIMP, DP)
1191                          17,2246  0 0006 1  NP1NODE   EXTEND          FORM NODE NP1....COLLECT  (PAST NP2)
1192  REP   1                17,2247  3 1542 0            DCA     NP2       (COMES HERE FROM REG. DAP CODING)
1193  REP   1                17,2250  53=737 1            DXCH    NP1TMP

1194  REP   5  LAST  964      17,2251  4 1561 0  BP1(NP0)  CS      NP0       DPXDP MULTIPLY FOR DENOMINATOR COMPONENT
1195                          17,2252  0 0006 1            EXTEND
1196  REP   2  LAST   99      17,2253  7 1436 0            MP      BP1
1197  REP   2  LAST  964      17,2254  21=737 1            DAS     NP1TMP
1198  REP   6  LAST  964      17,2255  4 1562 0            CS      NP0 +1
1199                          17,2256  0 0006 1            EXTEND
1200  REP   3  LAST  964      17,2257  7 1436 0            MP      BP1
1201  REP   3  LAST  964      17,2260  27=737 1            ADS     NP1TMP +1
1202  REP 103  LAST  955      17,2261  54 001 1            TS      L
1203                          17,2262  1 2264 1            TCF     +2
1204  REP   4  LAST  964      17,2263  27=736 0            ADS     NP1TMP
```

```
1205  REF   7  LAST  964   17,2264  4 1561 0          CS    NP0
1206                       17,2265  0 0006 1          EXTEND
1207  REF   4  LAST  964   17,2266  7 1437 1          MP    BP1 +1
1208  REF   5  LAST  964   17,2267  27'737 1          ADS   NP1TMP +1
1209  REF 104  LAST  964   17,2270  54 001 1          TS    L
1210                       17,2271  1 2273 1          TCF   +2
1211  REF   6  LAST  965   17,2272  27'736 0          ADS   NP1TMP

1212  REF   3  LAST  964   17,2273  31'742 1 AP1(EP)  CAE   EP          DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1213                       17,2274  0 0006 1          EXTEND
1214  REF   2  LAST   99   17,2275  7 1430 0          MP    AP1
1215  REF   7  LAST  965   17,2276  21'737 1          DAS   NP1TMP
1216  REF   4  LAST  965   17,2277  31'742 1          CAE   EP
1217                       17,2300  0 0006 1          EXTEND
1218  REF   3  LAST  965   17,2301  7 1431 1          MP    AP1 +1
1219  REF   6  LAST  965   17,2302  27'737 1          ADS   NP1TMP +1
1220  REF 105  LAST  965   17,2303  54 001 1          TS    L
1221                       17,2304  1 2306 1          TCF   +2
1222  REF   9  LAST  965   17,2305  27'736 0          ADS   NP1TMP      COMPLETED NODE NP1

1223                       17,2306  0 0006 1 NP2NODE  EXTEND            FORM NODE NP2....COLLECT (PAST NP3)
1224  REF   1              17,2307  3 1544 0          DCA   NP3
1225  REF   1              17,2310  53'712 0          DXCH  NP2TMP
1226  REF   6  LAST  965   17,2311  4 1561 0 BP2(NP0) CS    NP0         DPXDP MULTIPLY FOR DENOMINATOR COMPONENT
1227                       17,2312  0 0006 1          EXTEND
1228  REF   2  LAST  100   17,2313  7 1440 1          MP    BP2
1229  REF   2  LAST  965   17,2314  21'712 0          DAS   NP2TMP
1230  REF   9  LAST  965   17,2315  4 1562 0          CS    NP0 +1
1231                       17,2316  0 0006 1          EXTEND
1232  REF   3  LAST  965   17,2317  7 1440 1          MP    BP2
1233  REF   3  LAST  965   17,2320  27'712 0          ADS   NP2TMP +1
1234  REF 106  LAST  965   17,2321  54 001 1          TS    L
1235                       17,2322  1 2324 1          TCF   +2
1236  REF   4  LAST  965   17,2323  27'711 0          ADS   NP2TMP
1237  REF  10  LAST  965   17,2324  4 1561 0          CS    NP0
1236                       17,2325  0 0006 1          EXTEND
1239  REF   4  LAST  965   17,2326  7 1441 0          MP    BP2 +1
1240  REF   5  LAST  965   17,2327  27'712 0          ADS   NP2TMP +1
1241  REF 107  LAST  965   17,2330  54 001 1          TS    L
1242                       17,2331  1 2333 1          TCF   +2
1243  REF   6  LAST  965   17,2332  27'711 0          ADS   NP2TMP

1244  REF   5  LAST  965   17,2333  31'742 1 AP2(EP)  CAE   EP          DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1245                       17,2334  0 0006 1          EXTEND
1246  REF   2  LAST   99   17,2335  7 1432 1          MP    AP2
1247  REF   7  LAST  965   17,2336  21'712 0          DAS   NP2TMP
1248  REF   6  LAST  965   17,2337  31'742 1          CAE   EP
1249                       17,2340  0 0006 1          EXTEND
1250  REF   3  LAST  965   17,2341  7 1433 0          MP    AP2 +1
1251  REF   8  LAST  965   17,2342  27'712 0          ADS   NP2TMP +1
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1252  REP 106  LAST  965   17,2343  54 001 1            TS     L
1253                       17,2344  1 2346 0            TCF    +2
1254  REP   9  LAST  965   17,2345  27«711 0            ADS    NP2TMP        COMPLETED NODE NP2

1255  REP  11  LAST  965   17,2346  4 1561 0  NP3NODE   CS     NP0           FORM NODE NP3....NO PAST NODES, DIRECT
1256                       17,2347  0 0006 1            EXTEND                    TO DPXDP MULTIPLY FOR DENOMINATOR
1257  REP   2  LAST  100   17,2350  7 1442 0            MP     BP3               COMPONENT
1258  REP   1              17,2351  53«714 0            DXCH   NP3TMP
1259  REP  12  LAST  966   17,2352  4 1562 0            CS     NP0 +1
1260                       17,2353  0 0006 1            EXTEND
1261  REP   3  LAST  966   17,2354  7 1442 0            MP     BP3
1262  REP   2  LAST  966   17,2355  27«714 0            ADS    NP3TMP +1
1263  REP 109  LAST  966   17,2356  54 001 1            TS     L
1264                       17,2357  1 2361 0            TCF    +2
1265  REP   3  LAST  966   17,2360  27«713 1            ADS    NP3TMP
1266  REP  13  LAST  966   17,2361  4 1561 0            CS     NP0
1267                       17,2362  0 0006 1            EXTEND
1268  REP   4  LAST  966   17,2363  7 1443 1            MP     BP3 +1
1269  REP   4  LAST  966   17,2364  27«714 0            ADS    NP3TMP +1
1270  REP 110  LAST  966   17,2365  54 001 1            TS     L
1271                       17,2366  1 2370 0            TCF    +2
1272  REP   5  LAST  966   17,2367  27«713 1            ADS    NP3TMP

1273  REP   7  LAST  965   17,2370  31«742 1  AP3(EP)   CAE    EP            DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1274                       17,2371  0 0006 1            EXTEND
1275  REP   2  LAST   99   17,2372  7 1434 1            MP     AP3
1276  REP   6  LAST  966   17,2373  21«714 0            DAS    NP3TMP
1277  REP   6  LAST  966   17,2374  31«742 1            CAE    EP
1278                       17,2375  0 0006 1            EXTEND
1279  REP   3  LAST  966   17,2376  7 1435 0            MP     AP3 +1
1280  REP   7  LAST  966   17,2377  27«714 0            ADS    NP3TMP +1
1281  REP 111  LAST  966   17,2400  54 001 1            TS     L
1282                       17,2401  1 2403 0            TCF    +2
1283  REP   6  LAST  966   17,2402  27«713 1            ADS    NP3TMP        COMPLETED NODE NP3, AND PITCH GEN3DAP
A1284                                                                            FILTER COMPUTATIONS
1285  REP  55  LAST  964   17,2403  0 4574 0            TC     POSTJUMP      RETURN TO CSMDAP CODING FOR PITCH
1286  REP   1              17,2404   40526 1            CADR   DELBARP           OFFSET-TRACKER-FILTER COMPUTATIONS,
A1287                                                                            AND PITCH DAP COPYCYCLE.
```

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P1268   YAW GEN3DAP FILTER....

 1269                          17,2405  0 0006 1  NY0NODE  EXTEND          FORM NODE NY0....COLLECT  (PAST NY1)
 1290   REF   1                17,2406  3 1610 1           DCA     NY1          (COMES HERE FROM REG. DAP CODING)
 1291                          17,2407  20 001 1           DDOUBL
 1292                          17,2410  20 001 1           DDOUBL
 1293   REF   1                17,2411  53=606 1           DXCH    NY0

 1294   REF   1                17,2412  31=742 1  AY0(EY)  CAE     EY           SPXSP MULTIPLY FOR NUMERATOR COMPONENT
 1295                          17,2413  0 0006 1           EXTEND               EY = ERRBTMP,  SP, SC.AT B-1 REVS
 1296   REF   1                17,2414  7 1427 0           MP      AY0
 1297   REF   2  LAST  967     17,2415  21=606 1           DAS     NY0          COMPLETED NODE NY0, SC.AT B+1 REVS
 1298   REF   3  LAST  967     17,2416  31=605 0  NYDNODE  CAE     NY0          FORM NODE NYD....SPXDP MULTIPLY BY GAIN
 1299                          17,2417  0 0006 1           EXTEND
 1300   REF   1                17,2420  7 1651 0           MP      KYGEN3
 1301   REF   1                17,2421  53=745 1           DXCH    NYD
 1302   REF   4  LAST  967     17,2422  31=606 0           CAE     NY0 +1
 1303                          17,2423  0 0006 1           EXTEND
 1304   REF   2  LAST  967     17,2424  7 1651 0           MP      KYGEN3
 1305                          17,2425  22 007 0           ZL
 1306   REF 219  LAST  964     17,2426  22 000 1           LXCH    A
 1307   REF   2  LAST  967     17,2427  21=745 1           DAS     NYD          SC.AT B+4 ASCREV SINCE KYGEN3 AT B+1

 1308   REF   3  LAST  967     17,2430  53=745 1           DXCH    NYD          FIX UP SCALING
 1309                          17,2431  20 001 1           DDOUBL
 1310                          17,2432  20 001 1           DDOUBL
 1311                          17,2433  20 001 1           DDOUBL
 1312                          17,2434  20 001 1           DDOUBL
 1313   REF   4  LAST  967     17,2435  53=745 1           DXCH    NYD          COMPLETED NODE NYD, SC.AT 1ASCREV
 1314   REF  56  LAST  966     17,2436  0 4574 0           TC      POSTJUMP     TRANSFER BACK TO REGULAR DAP CODING FOR
 1315   REF   1                17,2437   40730 1          CADR    YOFFSET              OUTPUT  (NYD = CMDTMP, DP)
 1316                          17,2440  0 0006 1  NY1NODE  EXTEND              FORM NODE NY1....COLLECT  (PAST NY2)
 1317   REF   1                17,2441  3 1566 0           DCA     NY2                  (COMES HERE FROM REG. DAP CODING)
 1318   REF   1                17,2442  53=737 1           DXCH    NY1TMP

 1319   REF   5  LAST  967     17,2443  4 1605 1  BY1(NY0) CS      NY0          DPXDP MULTIPLY FOR DENOMINATOR COMPONENT
 1320                          17,2444  0 0006 1           EXTEND
 1321   REF   1                17,2445  7 1436 0           MP      BY1
 1322   REF   2  LAST  967     17,2446  21=737 1           DAS     NY1TMP
 1323   REF   6  LAST  967     17,2447  4 1606 1           CS      NY0 +1
 1324                          17,2450  0 0006 1           EXTEND
 1325   REF   2  LAST  967     17,2451  7 1436 0           MP      BY1
 1326   REF   3  LAST  967     17,2452  27=737 1           ADS     NY1TMP +1
 1327   REF 112  LAST  966     17,2453  54 001 1           TS      L
 1328                          17,2454  1 2456 0           TCF     +2
 1329   REF   4  LAST  967     17,2455  27=736 0           ADS     NY1TMP
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1330  REP   7  LAST  967   17,2456  4 1605 1          CS    NY0
1331                       17,2457  0 0006 1          EXTEND
1332  REP   3  LAST  967   17,2460  7 1437 1          MP    BY1 +1
1333  REP   5  LAST  967   17,2461  27∝737 1          ADS   NY1TMP +1
1334  REP 113  LAST  967   17,2462  54 001 1          TS    L
1335                       17,2463  1 2465 0          TCF   +2
1336  REP   6  LAST  968   17,2464  27∝736 0          ADS   NY1TMP

1337  REP   2  LAST  967   17,2465  31∝742 1  AY1(EY)  CAE   EY          DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1338                       17,2466  0 0006 1          EXTEND
1339  REP   1              17,2467  7 1430 0          MP    AY1
1340  REP   7  LAST  968   17,2470  21∝737 1          DAS   NY1TMP
1341  REP   3  LAST  968   17,2471  31∝742 1          CAE   EY
1342                       17,2472  0 0006 1          EXTEND
1343  REP   2  LAST  968   17,2473  7 1431 1          MP    AY1 +1
1344  REP   8  LAST  968   17,2474  27∝737 1          ADS   NY1TMP +1
1345  REP 114  LAST  968   17,2475  54 001 1          TS    L
1346                       17,2476  1 2500 1          TCF   +2
1347  REP   9  LAST  968   17,2477  27∝736 0          ADS   NY1TMP       COMPLETED NODE NY1

1348                       17,2500  0 0006 1  NY2NODE  EXTEND            FORM NODE NY2....COLLECT (PAST NY3)
1349  REP   1              17,2501  3 1570 1          DCA   NY3
1350  REP   1              17,2502  53∝712 0          DXCH  NY2TMP

1351  REP   8  LAST  968   17,2503  4 1605 1  BY2(NY0) CS    NY0         DPXDP MULTIPLY FOR DENOMINATOR COMPONENT
1352                       17,2504  0 0006 1          EXTEND
1353  REP   1              17,2505  7 1440 1          MP    BY2
1354  REP   2  LAST  968   17,2506  21∝712 0          DAS   NY2TMP
1355  REP   9  LAST  968   17,2507  4 1606 1          CS    NY0 +1
1356                       17,2510  0 0006 1          EXTEND
1357  REP   2  LAST  968   17,2511  7 1440 1          MP    BY2
1358  REP   3  LAST  968   17,2512  27∝712 0          ADS   NY2TMP +1
1359  REP 115  LAST  968   17,2513  54 001 1          TS    L
1360                       17,2514  1 2516 0          TCF   +2
1361  REP   4  LAST  968   17,2515  27∝711 0          ADS   NY2TMP
1362  REP  10  LAST  968   17,2516  4 1605 1          CS    NY0
1363                       17,2517  0 0006 1          EXTEND
1364  REP   3  LAST  966   17,2520  7 1441 0          MP    BY2 +1
1365  REP   5  LAST  968   17,2521  27∝712 0          ADS   NY2TMP +1
1366  REP 116  LAST  968   17,2522  54 001 1          TS    L
1367                       17,2523  1 2525 0          TCF   +2
1368  REP   6  LAST  968   17,2524  27∝711 0          ADS   NY2TMP

1369  REP   4  LAST  968   17,2525  31∝742 1  AY2(EY)  CAE   EY          DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1370                       17,2526  0 0006 1          EXTEND
1371  REP   1              17,2527  7 1432 1          MP    AY2
1372  REP   7  LAST  968   17,2530  21∝712 0          DAS   NY2TMP
1373  REP   5  LAST  968   17,2531  31∝742 1          CAE   EY
1374                       17,2532  0 0006 1          EXTEND
1375  REP   2  LAST  968   17,2533  7 1433 0          MP    AY2 +1
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1376  REF   8  LAST  966   17,2534  27"712 0          ADS   NY2TMP +1
1377  REF 117  LAST  968   17,2535  54 001 1          TS    L
1378                       17,2536  1 2540 0          TCF   +2
1379  REF   9  LAST  969   17,2537  27"711 0          ADS   NY2TMP        COMPLETED NODE NY2

1380  REF  11  LAST  968   17,2540  4 1605 1  NY3NODE CS    NY0           FORM NODE NY3....NO PAST NODES, DIRECT
1381                       17,2541  0 0006 1          EXTEND                   TO DPXDP MULTIPLY FOR DENOMINATOR
1382  REF   1              17,2542  7 1442 0          MP    BY3                COMPONENT
1383  REF   1              17,2543  53"714 0          DXCH  NY3TMP
1384  REF  12  LAST  969   17,2544  4 1606 1          CS    NY0 +1
1385                       17,2545  0 0006 1          EXTEND
1386  REF   2  LAST  969   17,2546  7 1442 0          MP    BY3
1387  REF   2  LAST  969   17,2547  27"714 0          ADS   NY3TMP +1
1388  REF 116  LAST  969   17,2550  54 001 1          TS    L
1389                       17,2551  1 2553 1          TCF   +2
1390  REF   3  LAST  969   17,2552  27"713 1          ADS   NY3TMP
1391  REF  13  LAST  969   17,2553  4 1605 1          CS    NY0
1392                       17,2554  0 0006 1          EXTEND
1393  REF   3  LAST  969   17,2555  7 1443 1          MP    BY3 +1
1394  REF   4  LAST  969   17,2556  27"714 0          ADS   NY3TMP +1
1395  REF 119  LAST  969   17,2557  54 001 1          TS    L
1396                       17,2560  1 2562 0          TCF   +2
1397  REF   5  LAST  969   17,2561  27"713 1          ADS   NY3TMP

1398  REF   6  LAST  968   17,2562  31"742 1  AY3(EY) CAE   EY            DPXSP MULTIPLY FOR NUMERATOR COMPONENT
1399                       17,2563  0 0006 1          EXTEND
1400  REF   1              17,2564  7 1434 1          MP    AY3
1401  REF   6  LAST  969   17,2565  21"714 0          DAS   NY3TMP
1402  REF   7  LAST  969   17,2566  31"742 1          CAE   EY
1403                       17,2567  0 0006 1          EXTEND
1404  REF   2  LAST  969   17,2570  7 1435 0          MP    AY3 +1
1405  REF   7  LAST  969   17,2571  27"714 0          ADS   NY3TMP +1
1406  REF 120  LAST  969   17,2572  54 001 1          TS    L
1407                       17,2573  1 2575 0          TCF   +2
1408  REF   6  LAST  969   17,2574  27"713 1          ADS   NY3TMP        COMPLETED NODE NY3, AND YAW GEN3DAP
A1409                                                                        FILTER COMPUTATIONS
1410  REF  57  LAST  967   17,2575  0 4574 0          TC    POSTJUMP      RETURN TO CSMDAP CODING FOR YAW
1411  REF   1              17,2576   41015 0          CADR  DELBARY            OFFSET-TRACKER-FILTER COMPUTATIONS,
A1412                                                                        AND YAW DAP COPYCYCLE.
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0001                        20,3565                 BANK    20
0002  REP   1              21,2000                 SETLOC  MYSUBS
0003                        21,2026                 BANK

0004  REP   3  LAST  202   E6,1510                 EBANK=  KMPAC
0005  REP   1               4767      SPCOS1      EQUALS  SPCOS
0006  REP   1               4770      SPSIN1      EQUALS  SPSIN
0007  REP   2  LAST  970    4767      SPCOS2      EQUALS  SPCOS
0008  REP   2  LAST  970    4770      SPSIN2      EQUALS  SPSIN
0009  REP   1                                     COUNT   21/DAPMS

R0010  ONE AND ONE HALF PRECISION MULTIPLICATION ROUTINE

0011  REP   2  LAST  106   21,2026  55"512 1  SMALLMP  TS      KMPTEMP     A(X+Y)
0012                        21,2027  0 0006 1           EXTEND
0013  REP   4  LAST  970   21,2030  7 1511 1           MP      KMPAC +1
0014  REP   5  LAST  970   21,2031  55"511 1           TS      KMPAC +1    AY
0015  REP 172  LAST  959   21,2032  3 4714 1           CAP     ZERO
0016  REP   6  LAST  970   21,2033  57"510 1           XCH     KMPAC
0017                        21,2034  0 0006 1           EXTEND
0018  REP   3  LAST  970   21,2035  7 1512 1           MP      KMPTEMP     AX
0019  REP   7  LAST  970   21,2036  21"511 1           DAS     KMPAC       AX+AY
0020  REP 189  LAST  945   21,2037  0 0002 0           TC      Q
R0021  SUBROUTINE FOR DOUBLE PRECISION ADDITIONS OF ANGLES
R0022  A AND L CONTAIN A DP(1S) ANGLE SCALED BY 180 DEGS TO BE ADDED TO KMPAC.
R0023  RESULT IS PLACED IN KMPAC.  TIMING = 6 MCT (22 MCT ON OVERFLOW)

0024  REP   8  LAST  970   21,2040  21"511 1  DPADD    DAS     KMPAC
0025                        21,2041  0 0006 1           EXTEND
0026  REP   1               21,2042  1 2057 0           BZF     TSK +1      NO OVERFLOW
0027  REP   9  LAST  970   21,2043  11"510 0           CCS     KMPAC
0028  REP   1               21,2044  1 2060 1           TCF     DPADD+      + OVERFLOW
0029                        21,2045  1 2047 1           TCF     +2
0030  REP   1               21,2046  1 2062 0           TCF     DPADD-      - OVERFLOW
0031  REP  10  LAST  970   21,2047  11"511 1           CCS     KMPAC +1
0032  REP   1               21,2050  1 2065 1           TCF     DPADD2+     UPPER = 0, LOWER +
0033                        21,2051  1 2053 1           TCF     +2
0034                        21,2052  4 0000 0           COM                 UPPER = 0, LOWER -
0035  REP  22  LAST  957   21,2053  6 4672 0           AD      POSMAX      LOWER = 0, A=0
0036  REP  11  LAST  970   21,2054  55"511 1           TS      KMPAC +1    CAN NOT OVERFLOW
0037  REP  23  LAST  970   21,2055  3 4672 0           CA      POSMAX      UPPER WAS = 0
0038  REP  12  LAST  970   21,2056  55"510 0  TSK      TS      KMPAC
0039  REP 190  LAST  970   21,2057  0 0002 0           TC      Q

0040  REP   5  LAST  957   21,2060  6 4674 0  DPADD+   AD      NEGMAX      KMPAC GREATER THAN 0
0041  REP   2  LAST  970   21,2061  1 2056 1           TCF     TSK
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0042                        21,2062  4 0000 0  DPADD-    COM
0043   REP  24  LAST  970   21,2063  6 4672 0            AD      POSMAX      KMPAC LESS THAN 0
0044   REP   3  LAST  970   21,2064  1 2056 1            TCF     TSK

0045   REP   6  LAST  970   21,2065  6 4674 0  DPADD2+   AD      NEGMAX      CAN NOT OVERFLOW
0046   REP  13  LAST  970   21,2066  55=511 1            TS      KMPAC +1
0047   REP   7  LAST  971   21,2067  3 4674 0            CA      NEGMAX      UPPER WAS = 0
0048   REP   4  LAST  971   21,2070  1 2056 1            TCF     TSK
```

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P0001   T5 INTERRUPT PROGRAM FOR THE RCS-CSM AUTOPILOT
R0002        START OF T5 INTERRUPT PROGRAM
 0003                          20,3565                    BANK    20
 0004   REP   2  LAST  691     21,2000                    SETLOC  DAPS3
 0005                          21,2071                    BANK

 0006   REP   1                                          COUNT   21/DAPRC

 0007   REP  14  LAST  971     E6,1510                    EBANK=  KMPAC
 0008   REP  16  LAST  959     21,2071   22 016 0  REDORCS  LXCH   BANKRUPT     RESTART OF AUTOPILOT COMES HERE
 0009   REP   2  LAST  692     21,2072   3 1465 1         CA     T5PHASE     ON A T5 RUPT.
 0010                          21,2073   0 0006 1         EXTEND
 00101                         21,2074   6 2076 1         BZMF   +2          IF T5PHASE +0, -0, OR -, RESET TO -
 00102                         21,2075   1 2100 0         TCF    +3          IF T5PHASE +, LEAVE IT +.  DO A FRESHDAP
 00103  REP 102  LAST  956     21,2076   4 4712 0         CS     ONE
 00104  REP   3  LAST  973     21,2077   55=465 0         TS     T5PHASE
 0011                          21,2100   0 0006 1         EXTEND
 0012   REP   1                21,2101   3 2105 1         DCA    RCSLOC
 0013   REP  19  LAST  936     21,2102   53=313 0         DXCH   T5LOC       HOOK UP T5RUPT TO AUTOPILOT
 0014   REP   3  LAST  692     21,2103   1 2107 1         TCF    RCSATT +1
 0015   REP  15  LAST  973     E6,1510                    EBANK=  KMPAC
 0016   REP   4  LAST  973     21,2104    02106 1  RCSLOC  2CADR  RCSATT
 0016                          21,2105    42066 1
 0017   REP  17  LAST  973     21,2106   22 016 0  RCSATT   LXCH   BANKRUPT     SAVE BB
 0016                          21,2107   0 0006 1         EXTEND                 SAVE Q
 0019   REP  13  LAST  930     21,2110   22 012 1         QXCH   QRUPT
 0020   REP  40  LAST  956     21,2111   3 4674 0         CAF    BIT15       BIT15 CHAN31 = 0 IF IMU POWER IS ON AND
 0021                          21,2112   0 0006 1         EXTEND             S/C CONT SW IS IN CMC (I.E. IF G/C AUTO
 0022   REP   5  LAST  662     21,2113   02 031 1         RAND   CHAN31       PILOT IS FULLY ENABLED)
 0023                          21,2114   0 0006 1         EXTEND
 0024   REP   1                21,2115   1 2144 0         BZF    SETT5       IF G/C AUTOPILOT IS FULLY ENABLED,
A0025                                                                        GO TO SETT5

 0026   REP  14  LAST  901     21,2116   4 1501 0         CS     RCSFLAGS    IF G/C AUTOPILOT IS NOT FULLY ENABLED,
 0027   REP  51  LAST  953     21,2117   7 4675 0         MASK   BIT14
 0028   REP  15  LAST  973     21,2120   27=501 0         ADS    RCSFLAGS    SET NORATE FLAG,
 0029   REP  25  LAST  971     21,2121   3 4672 0         CAF    POSMAX
 0030   REP   7  LAST  690     21,2122   55=332 0         TS     HOLDFLAG    SET HOLDFLAG +,
 00301  REP 173  LAST  970     21,2123   3 4714 1         CAF    ZERO        ZERO ERRORX, ERRORY, AND ERRORZ,
 00302  REP   5  LAST  173     21,2124   55=567 0         TS     ERRORX
 00303  REP   3  LAST  111     21,2125   55=570 0         TS     ERRORY
 00304  REP   2  LAST  107     21,2126   55=571 1         TS     ERRORZ
 0031   REP  52  LAST  973     21,2127   3 4675 1         CAF    BIT14
 0032                          21,2130   0 0006 1         EXTEND
 0033   REP   6  LAST  973     21,2131   02 031 1         RAND   CHAN31       AND CHECK FREE FUNCTION (BIT14 CHAN31).
 003309                        21,2132   0 0006 1         EXTEND
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 00331  REF   2  LAST  973   21,2133  1 2144 0          BZF    SETT5          IF IN FREE MODE, GO TO SETT5.

 00332  REF   4  LAST  973   21,2134  55=465 0          TS     T5PHASE        IF NOT IN FREE MODE,
 00333  REF   1               21,2135  3 7676 1          CAF    OCT37766       SCHEDULE REINITIALIZATION (FRESHDAP)
 00334  REF  15  LAST  936   21,2136  54 030 0          TS     TIME5          IN 100 MS VIA T5RUPT

 00335  REF   3  LAST  690   21,2137  0 2616 1          TCR    ZEROJET        ZERO JET CHANNELS IN 14 MS VIA ZEROJET

 0034   REF   1               21,2140  1 2334 0          TCF    KMATRIX
 0035                         21,2141   37770 0 DELTATT  OCT    37770          60MS (TIME5)
 0036                         21,2142   37776 0 DELTATT2 OCT    37776          20MS (TIME5)
 0037                         21,2143   37634 1 ONESEK   DEC    16264          1 SEC(TIME5)
 0036                            0005         CHAN5    EQUALS 5
 0039                            0006         CHAN6    EQUALS 6
 0043   REF   4  LAST  227      7671         PRIO34A  =      PRIO34
R0044           CHECK PHASE OF T5 PROGRAM

R0045       BECAUSE OF THE LENGTH OF THE T5 PROGRAM, IT HAS BEEN DIVIDED INTO
R0046   THREE PARTS, T5PHASE1, T5PHASE2, AND THE JET SELECTION LOGIC,
R0047   TO ALLOW FOR THE EXECUTION OF OTHER
R0048   INTERRUPTS.  T5PHASE IS ALSO USED IN THE INITIALIZATION OF THE AUTOPILOT
R0049   VARIABLES AT TURN ON.
R0050   THE CODING OF T5PHASE IS...

R0051                + = INITIALIZE T5 RCS-CSM AUTOPILOT
R0052   T5PHASE = +0 = PHASE2 OF THE T5 PROGRAM
R0053             - = RESTART DAP
R0054             -0 = PHASE1 OF THE T5 PROGRAM

 0055   REF   5  LAST  974   21,2144  11=465 0  SETT5    CCS    T5PHASE
 0056   REF   1               21,2145  1 2530 1          TCF    FRESHDAP       TURN ON AUTOPILOT
 0057   REF   1               21,2146  1 2645 0          TCF    T5PHASE2       BRANCH TO PHASE2 OF PROGRAM
 0056   REF   1               21,2147  1 2532 0          TCF    REDAP          RESTART AUTOPILOT
 0059   REF   6  LAST  974   21,2150  55=465 0          TS     T5PHASE        PHASE 1  RESET  FOR PHASE 2
 0060   REF  16  LAST  974   21,2151  3 0030 1          CA     TIME5
 0061   REF   2  LAST  107   21,2152  55=634 0          TS     T5TIME         USED IN COMPENSATING FOR DELAYS IN T5
 0062   REF   1               21,2153  3 2142 1          CAF    DELTATT2       RESET FOR T5RUPT IN 20MS FOR PHASE2
 0063   REF  17  LAST  974   21,2154  54 030 0          TS     TIME5          OF PROGRAM
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P0064   IMU STATUS CHECK

 0065   REF  26  LAST  381   21,2155  4 1321 1          CS     IMODES33    CHECK IMU STATUS
 0066   REF  36  LAST  777   21,2156  7 4705 0          MASK   BIT8       BIT8 = 0  IMU OK
 0067   REF 220  LAST  967   21,2157  10 000 0          CCS    A           BIT8 = 1 NO IMU
 0068   REF   1              21,2160  1 2174 0          TCF    RATEFILT
 0069   REF  16  LAST  973   21,2161  4 1501 0 FREECHK  CS     RCSFLAGS    BIT14 INDICATES THAT RATES HAVE NOT BEEN
 0070   REF  53  LAST  973   21,2162  7 4675 0          MASK   BIT14       INITIALIZED
 0071   REF  17  LAST  975   21,2163  27=501 0          ADS    RCSFLAGS
 0072   REF  54  LAST  975   21,2164  3 4675 1          CAF    BIT14       NO ATTITUDE REFERENCE
 0073   REF   6  LAST  973   21,2165  55=332 0          TS     HOLDFLAG    STOP ANY AUTOMATIC STEERING AND PREPARE
A0074                                                                     TO PICK UP CDU ANGLES UPON RESUMPTION OF
A0075                                                                     ATTITUDE HOLD
 0076                         21,2166  0 0006 1          EXTEND
 0077   REF   7  LAST  973   21,2167  02 031 1          RAND   CHAN31      CHECK FOR FREE MODE
 0078                         21,2170  0 0006 1          EXTEND
 0079   REF   1              21,2171  1 2403 0          BZF    RESUME1     IN FREE MODE PROVIDE FREE CONTROL ONLY
 0080   REF   1              21,2172  1 2520 0          TCF    REINIT      .....TILT.....
 0081                         21,2173   00030 1 BITS4,5  CCT    30
 0082   REF  18  LAST  975   21,2174  3 1501 1 RATEFILT CA     RCSFLAGS    SEE IF RATEFILTER HAS BEEN INITIALIZED
 0083   REF  55  LAST  975   21,2175  7 4675 0          MASK   BIT14
 0084                         21,2176  0 0006 1          EXTEND              IF SO, PROCEED WITH RATE DERIVATION
 0085                         21,2177  1 2201 1          BZF    +2
 0086   REF   2  LAST  974   21,2200  1 2334 0          TCF    KMATRIX      IF NOT, SKIP RATE DERIVATION

R0087            RATE FILTER      TIMING = 7.72MS

R0088   RATE FILTER EQUATIONS
R0089   DRHO = DELRHO - (  )ADOT + (1 - GAIN1)DRHO
R0090                      -1
R0091   ADOT = ADOT    + GAIN2 DRHO + KMJ DFT
R0092          -1
R0093        -      *    -     -
R0094   WHERE DELRHO = AMGB (CDU - CDU  )
R0095                             -1

 0096   REF  38  LAST  905   21,2201  3 4711 1          CAF    TWO
 0097   REF   3  LAST  110   21,2202  55=506 1 DRHOLOOP TS     SPNDX
 0098                         21,2203  6 0000 1          DOUBLE
 0099   REF   2  LAST  106   21,2204  55=507 0          TS     DPNDX
 0100   REF   3  LAST  975   21,2205  51=507 1          INDEX  DPNDX
 0101   REF   2  LAST  106   21,2206  4 1552 0          CS     DRHO        DRHO SCALED 180 DEGS
 0102                         21,2207  0 0006 1          EXTEND
 0103   REF   2  LAST  107   21,2210  5 1617 0          INDEX  ATTKALMN    PICK UP DESIRED FILTER GAIN
 0104   REF   1              21,2211  7 3063 0          MP     GAIN1
 0105   REF   4  LAST  975   21,2212  51=507 1          INDEX  DPNDX
 0106   REF   3  LAST  975   21,2213  21=553 1          DAS    DRHO        (1 -.064)DRHO
 0107                         21,2214  0 0006 1          EXTEND
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0108  REF  5  LAST  975   21,2215  5 1507 1     INDEX  DPNDX
0109  REF  6  LAST  168   21,2216  4 1534 0     DCS    ADOT
0110  REF 16  LAST  973   21,2217  53"511 1     DXCH   KMPAC      -(.1)ADOT
0111  REF  2  LAST  280   21,2220  3 4676 1     CA     QUARTER
0112  REF  1               21,2221  0 2026 1     TC     SMALLMP
0113  REF 17  LAST  976   21,2222  53"511 1     DXCH   KMPAC
0114  REF  6  LAST  976   21,2223  51"507 1     INDEX  DPNDX
0115  REF  4  LAST  975   21,2224  21"553 1     DAS    DRHO
0116  REF  4  LAST  975   21,2225  11"506 1     CCS    SPNDX
0117  REF  1               21,2226  1 2202 1     TCF    DRHOLOOP

0118  REF 20  LAST  904   21,2227  3 0032 0     CA     CDUX       MEASURED BODY RATES--
0119  REF  2  LAST  107   21,2230  57"635 0     XCH    RHO
0120                       21,2231  0 0006 1     EXTEND
0121  REF  3  LAST  976   21,2232  21"635 1     MSU    RHO        -      *    -    -
0122                       21,2233  4 0000 0     COM            DELRHO = AMGB (CDU - CDU  )
A0123                                                                          -1
0124                       21,2234  22 007 0     ZL
01241 REF  2  LAST  106   21,2235  53"516 0     DXCH   DELTEMPX
0125  REF 11  LAST  936   21,2236  3 0033 1     CA     CDUY
0126  REF  2  LAST  107   21,2237  57"636 0     XCH    RHO1
0127                       21,2240  0 0006 1     EXTEND
0128  REF  3  LAST  976   21,2241  21"636 1     MSU    RHO1
0129                       21,2242  4 0000 0     COM
0130  REF  1               21,2243  55"502 0     TS     TSTEMP     (CDUY - RHO1)    SCALED 90 DEGS
0131                       21,2244  0 0006 1     EXTEND
0132  REF  2  LAST  107   21,2245  7 1640 0     MP     AMGB1
0133  REF  3  LAST  976   21,2246  21"516 0     DAS    DELTEMPX   DELTEMPX = (CDUX-RHO) + AMGB1(CDUY-RHO1)
A0134                                                             MUST BE DOUBLE PRECISION OR WILL LOSE
A0135                                                             PULSES
0136  REF  2  LAST  108   21,2247  3 1641 0     CA     AMGB4
0137                       21,2250  0 0006 1     EXTEND
0138  REF  2  LAST  976   21,2251  7 1502 0     MP     TSTEMP
0139  REF  2  LAST  106   21,2252  53"520 0     DXCH   DELTEMPY
0140  REF  2  LAST  108   21,2253  3 1643 1     CA     AMGB7
0141                       21,2254  0 0006 1     EXTEND
0142  REF  3  LAST  976   21,2255  7 1502 0     MP     TSTEMP
0143  REF  1               21,2256  53"522 1     DXCH   DELTEMPZ
0144  REF 14  LAST  936   21,2257  3 0034 0     CA     CDUZ
0145  REF  2  LAST  107   21,2260  57"637 1     XCH    RHO2
0146                       21,2261  0 0006 1     EXTEND
0147  REF  3  LAST  976   21,2262  21"637 0     MSU    RHO2
0148                       21,2263  4 0000 0     COM
0149  REF  4  LAST  976   21,2264  55"502 0     TS     TSTEMP     (CDUZ - RHO2)    SCALED 90 DEGS
0150                       21,2265  0 0006 1     EXTEND
0151  REF  2  LAST  106   21,2266  7 1642 1     MP     AMGB5
0152  REF  3  LAST  976   21,2267  21"520 0     DAS    DELTEMPY   DELTEMPY =AMGB4(CDUY-RHO1)
A01521                                                                      + AMGB5(CDUZ-RHO2)
0153  REF  2  LAST  108   21,2270  3 1644 0     CA     AMGB8
0154                       21,2271  0 0006 1     EXTEND
```

```
0155  REF   5  LAST  976   21,2272  7 1502 0          MP     T5TEMP
0156  REF   2  LAST  976   21,2273  21"522 1          DAS    DELTEMPZ      DELTEMPZ =AMGB7(CDUY-RHO1)
A01561                                                                              + AMGB8(CDUZ-RHO2)
0157  REF  39  LAST  975   21,2274  3 4711 1          CAF    TWO
0158  REF   5  LAST  976   21,2275  55"506 1  ADOTLOOP TS     SPNDX
0159                        21,2276  6 0000 1          DOUBLE
0160  REF   7  LAST  976   21,2277  55"507 0          TS     DPNDX
01601                       21,2300  0 0006 1          EXTEND
01602 REF   8  LAST  977   21,2301  5 1507 1          INDEX  DPNDX
01603 REF   4  LAST  976   21,2302  3 1516 1          DCA    DELTEMPX
01604 REF   9  LAST  977   21,2303  51"507 1          INDEX  DPNDX
01605 REF   5  LAST  976   21,2304  21"553 1          DAS    DRHO
01606                       21,2305  0 0006 1          EXTEND
01607 REF  10  LAST  977   21,2306  5 1507 1          INDEX  DPNDX
01608 REF   5  LAST  977   21,2307  3 1516 1          DCA    DELTEMPX
01609 REF  11  LAST  977   21,2310  51"507 1          INDEX  DPNDX
01609?1 REF  2  LAST  106   21,2311  21"542 1          DAS    MERRORX
0161  REF  12  LAST  977   21,2312  51"507 1          INDEX  DPNDX
0162  REF   6  LAST  977   21,2313  3 1552 1          CA     DRHO
0163                        21,2314  6 0000 1          DOUBLE                N.B.
0164                        21,2315  6 0000 1          DOUBLE                N.B.
0165                        21,2316  0 0006 1          EXTEND
0166  REF   3  LAST  975   21,2317  5 1617 0          INDEX  ATTKALMN      PICK UP DESIRED FILTER GAINS
0167  REF   1               21,2320  7 3101 0          MP     GAIN2
0168  REF  13  LAST  977   21,2321  51"507 1          INDEX  DPNDX         ADOT  + (.16)(.1)DRHO
0169  REF   7  LAST  976   21,2322  21"534 0          DAS    ADOT                -1
0170  REF   6  LAST  977   21,2323  51"506 0          INDEX  SPNDX         S/C TORQUE TO INERTIA RATIO
0171  REF   3  LAST  691   21,2324  3 1620 1          CA     KMJ           SCALED (450)(1600)/(57.3)(16384)=1/1.3
0172                        21,2325  0 0006 1          EXTEND
0173  REF   7  LAST  977   21,2326  5 1506 0          INDEX  SPNDX
0174  REF   2  LAST  106   21,2327  7 1547 1          MP     DFT
0175  REF  14  LAST  977   21,2330  51"507 1          INDEX  DPNDX
0176  REF   6  LAST  977   21,2331  21"534 0          DAS    ADOT          KMJ(DFT)
0177  REF   6  LAST  977   21,2332  11"506 1          CCS    SPNDX
0178  REF   1               21,2333  1 2275 1          TCF    ADOTLOOP      END CALCULATION OF VEHICLE RATES
0179  REF   2  LAST  107   21,2334  3 1560 0  KMATRIX CA     ATTSEC
0180  REF   2  LAST  633   21,2335  7 4721 0          MASK   LOW4
0181  REF 221  LAST  975   21,2336  10 000 0          CCS    A
0182  REF   1               21,2337  1 2345 0          TCF    TENTHSEK
0183  REF   5  LAST  974   21,2340  3 7671 0          CAF    PRIO34        CALL FOR 1 SEC UPDATE OF TRANSFORMATION
0184  REF  28  LAST  629   21,2341  0 5027 1          TC     NOVAC         MATRIX FROM GIMBAL AXES TO BODY AXES
0185  REF  18  LAST  976   E6,1510                    EBANK= KMPAC
0186  REF   1               21,2342   03444 0         2CADR  AMBGUPDT
0186  REF   1               21,2343   44066 1
0187  REF   4  LAST  916   21,2344  3 4334 1          CAF    NINE

0188  REF   3  LAST  977   21,2345  55"560 1  TENTHSEK TS     ATTSEC
```

```
P0169   WHEN AUTOMATIC MANEUVERS ARE BEING PERFORMED, THE FOLLOWING ANGLE ADDITION MUST BE MADE TO PROVIDE A SMOOTH
R0191   SEQUENCE OF ANGULAR COMMANDS TO THE AUTOPILOT--

R0192           CDUXD = CDUXD + DELCDUX    (DOUBLE PRECISION)
R0193           CDUYD = CDUYD + DELCDUY    (DOUBLE PRECISION)
R0194           CDUZD = CDUZD + DELCDUZ    (DOUBLE PRECISION)

R0195   THE STEERING PROGRAMS-
R0196           1) ATTITUDE MANEUVER ROUTINE
R0196           2) LEM TRACKING

R0199   SHOULD GENERATE THE DESIRED ANGLES (CDUXD, CDUYD, CDUZD) AS WELL AS THE INCREMENTAL ANGLES (DELCDUX, DELCDUY,
R0201   DELCDUZ) SO THAT THE GIMBAL ANGLE COMMANDS CAN BE INTERPOLATED BETWEEN UPDATES.

R0203   HOLDFLAG CODING-

R0204       + = GRAB PRESENT CDU ANGLES AND STORE IN THETADX, THETADY, THETADZ
R0205           AND PERFORM ATTITUDE HOLD ABOUT THESE ANGLES
R0206           ALSO IGNORE AUTOMATIC STEERING
R0207           SET = + BY
R0208                 1) INITIALIZATION PHASE OF AUTOPILOT
R0209                 2) OCCURANCE OF RHC COMMANDS
R0210                 3) FREE MODE
R0211                 4) SWITCH OVER TO ATTITUDE HOLD FROM AUTO
R0212                    WHILE DOING AUTOMATIC STEERING (IN THIS CASE
R021203                  HOLDFLAG IS NOT ACTUALLY SET TO +, BUT THE LOGIC
R021205                  FUNCTIONS AS IF IT WERE.)
R02121                5) S/C CONTROL SWITCH IN SCS
R02122                6) IMU POWER OFF
R0213       +0 = IN ATTITUDE HOLD ABOUT A PREVIOUSLY ESTABLISHED REFERENCE
R0214       -  = PERFORMING AUTOMATIC MANEUVER
R0215       -0 = NOT USED AT PRESENT
R0216          NOTE THAT THIS FLAG MUST BE  SET = -  BY THE STEERING PROGRAM IF IT IS TO COMMAND THE AUTOPILOT.
R0218   SINCE ASTRONAUT ACTION MAY CHANGE THE HOLDFLAG SETTING, IT SHOULD BE MONITORED BY THE STEERING PROGRAM TO
R0220   DETERMINE IF THE AUTOMATIC SEQUENCE HAS BEEN INTERRUPTED AND IF SO, TAKE APPROPRIATE ACTION.
 0222   REF   9  LAST  975   21,2346  4 1332 0          CS      HOLDFLAG
 0223                        21,2347  0 0006 1          EXTEND
 0224   REF   1              21,2350  6 2375 1          BZMF    DACNDLS        IF HOLDFLAG +0,-0,+, BYPASS AUTOMATIC
A0225                                                                          COMMANDS
 0226   REF  40  LAST  977   21,2351  3 4711 1  DCDUINCR CAF     TWO
 0227   REF   9  LAST  977   21,2352  55<506 1  DELOOP   TS      SPNDX
 0228                        21,2353  6 0000 1          DOUBLE
 0229   REF  15  LAST  977   21,2354  55<507 0          TS      DPNDX
 0230                        21,2355  0 0006 1          EXTEND
 0231   REF 222  LAST  977   21,2356  5 0000 1          INDEX   A
 0232   REF   9  LAST  585   21,2357  3 1647 0          DCA     CDUXD
```

```
0233  REF  19  LAST  977   21,2360  53«511 1        DXCH  KMPAC
0234                       21,2361  0 0006 1        EXTEND
0235  REF  16  LAST  976   21,2362  5 1507 1        INDEX DPNDX
0236  REF   6  LAST  566   21,2363  3 1576 1        DCA   DELCDUX
0237  REF   1              21,2364  0 2040 1        TC    DPADD
0236                       21,2365  0 0006 1        EXTEND
0239  REF  20  LAST  979   21,2366  3 1511 0        DCA   KMPAC
0240  REF  10  LAST  978   21,2367  51«506 0        INDEX SPNDX
0241  REF   5  LAST  643   21,2370  55«572 1        TS    THETADX
0242  REF  17  LAST  979   21,2371  51«507 1        INDEX DPNDX
0243  REF  10  LAST  978   21,2372  53«647 1        DXCH  CDUXD
0244  REF  11  LAST  979   21,2373  11«506 1        CCS   SPNDX
0245  REF   1              21,2374  .1 2352 0       TCF   DELOOP
```

P0246 RCS-CSM AUTOPILOT ATTITUDE ERROR DISPLAY

R0247 THREE TYPES OF ATTITUDE ERRORS MAY BE DISPLAYED ON THE FDAI-

R0248 MODE 1) AUTOPILOT FOLLOWING ERRORS SELECTED BY V81E
R0250 GENERATED INTERNALLY BY THE AUTOPILOT

R0251 MODE 2) TOTAL ATTITUDE ERRORS SELECTED BY V82E
R0253 WITH RESPECT TO THE CONTENTS OF N22

R02531 MODE 3) TOTAL ASTRONAUT ATTITUDE ERRORS SELECTED BY V83E
R02533 WITH RESPECT TO THE CONTENTS OF N17

R0254 MODE 1 IS PROVIDED AS A MONITOR OF THE RCS DAP AND ITS ABILITY TO TRACK AUTOMATIC STEERING COMMANDS. IN THIS
R0256 MODE THE ATTITUDE ERRORS WILL BE ZEROED WHEN THE CMC MODE SWITCH IS IN FREE

R0259 MODE 2 IS PROVIDED TO ASSIST THE CREW IN MANUALLY MANEUVERING THE S/C TO THE ATTITUDE (GIMBAL ANGLES) SPECIFIED
R0261 IN N22. THE ATTITUDE ERRORS WRT THESE ANGLES AND THE CURRENT CDU ANGLES ARE RESOLVED INTO S/C CONTROL AXES
R0263 AS A FLY-TO INDICATOR.

R02631 MODE 3 IS PROVIDED TO ASSIST THE CREW IN MANUALLY MANEUVERING THE S/C TO THE ATTITUDE (GIMBAL ANGLES) SPECIFIED
R02633 IN N17. THE ATTITUDE ERRORS WRT THESE ANGLES AND THE CURRENT CDU ANGLES ARE RESOLVED INTO S/C CONTROL AXES
R02635 AS A FLY-TO INDICATOR.

R0264 V60 IS PROVIDED TO LOAD N17 WITH A SNAPSHOT OF THE CURRENT CDU ANGLES, THUS SYNCHRONIZING THE MODE 3 DISPLAY
R0266 WITH THE CURRENT S/C ATTITUDE. THIS VERB MAY BE USED AT ANY TIME.

R0269 THESE DISPLAYS WILL BE AVAILIABLE IN ANY MODE (AUTO, HOLD, FREE, G+N, OR SCS) ONCE THE RCS DAP HAS BEEN
R0271 INITIATED VIA V46E. MODE 1, HOWEVER, WILL BE MEANINGFUL ONLY IN G+N AUTO OR HOLD. THE CREW MAY PRESET (VIA
R0273 V25N17) AN ATTITUDE REFERENCE (DESIRED GIMBAL ANGLES) INTO N17 AT ANY TIME.

```
0278  REP  19  LAST  975   21,2375  4 1501 0  DACNDLS  CS      RCSFLAGS        ALTERNATE BETWEEN FDAIDSP1 AND FDAIDSP2
0279  REP  32  LAST  700   21,2378  7 4707 1            MASK    BIT4
0280                       21,2377  0 0006 1            EXTEND
0281  REP   1             21,2400  1 3144 1            BZF     FDAIDSP2

0282  REP  20  LAST  980   21,2401  27#501 0  FDAIDSP1  ADS     RCSFLAGS
0283  REP   7  LAST  904   21,2402  0 2404 0            TC      NEEDLER
0284  REP  33  LAST  933   21,2403  1 5222 1  KRESUME1  TCF     RESUME          END PHASE 1
```

```
P0285   FDAI ATTITUDE ERROR DISPLAY SUBROUTINE

R0286   PROGRAM DESCRIPTION'    D. KEENE   5/24/67

R0287       THIS SUBROUTINE IS USED TO DISPLAY ATTITUDE ERRORS ON THE FDAI VIA THE DIGITAL TO ANALOG CONVERTERS (DACS)
R0289   IN THE CDUS.  CARE IS TAKEN TO METER OUT THE APPROPRIATE NUMBER OF PULSES TO THE IMU ERROR COUNTERS AND PREVENT
R0291   OVERFLOW, TO CONTROL THE RELAY SEQUENCING, AND TO AVOID INTERFERENCE WITH THE COARSE ALIGN LOOP WHICH ALSO USES
R0293   THE DACS.
R0294   CALLING SEQUENCE'

R0295       DURING THE INITIALIZATION SECTION OF THE USER'S PROGRAM, BIT3 OF RCSFLAGS SHOULD BE SET TO INITIATE THE
R0297   TURN-ON SEQUENCE WITHIN THE NEEDLES PROGRAM'

R0298           CS      RCSFLAGS        IN EBANK6
R0299           MASK    BIT3
R0300           ADS     RCSFLAGS

R0301   THEREAFTER, THE ATTITUDE ERRORS GENERATED BY THE USER SHOULD BE TRANSFERED TO THE FOLLOWING LOCATIONS IN EBANK6'

R0303           AK      SCALED 180 DEGREES  NOTE' THESE LOCATIONS ARE SUBJECT
R0304           AK1     SCALED 180 DEGREES        TO CHANGE
R0305           AK2     SCALED 180 DEGREES

R0306   FULL SCALED DEFLECTION CORRESPONDS TO 16 7/8 DEGREES OF ATTITUDE ERROR
R0307           (= 384 BITS IN IMU ERROR COUNTER)

R0308   A CALL TO NEEDLER WILL THEN UPDATE THE DISPLAY'

R0309           INHINT
R0310           TC      IBNKCALL        NOTE' EBANK SHOULD BE SET TO E6
R0311           CADR    NEEDLER
R0312           RELINT

R0313       THIS PROCESS SHOULD BE REPEATED EACH TIME THE ERRORS ARE UPDATED.  AT LEAST 3 PASSES THRU THE PROGRAM ARE
R0315   REQUIRED BEFORE ANYTHING IS ACTUALLY DISPLAYED ON THE ERROR METERS.
R0316   NOTE' EACH CALL TO NEEDLER MUST BE SEPARATED BY AT LEAST 50MS TO ASSURE PROPER RELAY SEQUENCING.

R0318   ERASABLE USED'
R0319                           AK          CDUXCMD
R0320                           AK1         CDUYCMD
R0321                           AK2         CDUZCMD
R0322                           EDRIVEX     A,L,Q
R0323                           EDRIVEY     T5TEMP
R0324                           EDRIVEZ     SPNDX

R0325   SWITCHES'               RCSFLAGS    BITS 3,2

R0326   I/O CHANNELS'           CHAN12      BIT 4 (COARSE ALIGN - READ ONLY)
```

```
R0327                          CHAN12     BIT 6 (IMU ERROR COUNTER ENABLE)
R0328                          CHAN14     BIT 13,14,15 (DAC ACTIVITY)
R0329   SIGN CONVENTION±    AK = THETAC - THETA
R0330          WHERE        THETAC = COMMAND ANGLE
R0331                       THETA  = PRESENT ANGLE
 0332   REF  33  LAST  980   21,2404  3 4707 0  NEEDLER  CAF     BIT4      CHECK FOR COARSE ALIGN ENABLE
 0333                        21,2405  0 0008 1           EXTEND              IF IN COARSE ALIGN DO NOT USE IMU
 0334   REF  33  LAST  918   21,2406  02 012 0           RAND    CHAN12      ERROR COUNTERS. DONT USE NEEDLES
 0335                        21,2407  0 0006 1           EXTEND
 0336   REF   1              21,2410  1 2415 1           BZF     NEEDLER1
 0337   REF  21  LAST  960   21,2411  4 1501 0           CS      RCSFLAGS    SET BIT3 FOR INITIALIZATION PASS
 0338   REF  29  LAST  980   21,2412  7 4710 1           MASK    BIT3
 0339   REF  22  LAST  982   21,2413  27∝501 0           ADS     RCSFLAGS
 0340   REF 191  LAST  970   21,2414  0 0002 0           TC      Q

 0341   REF  23  LAST  962   21,2415  3 1501 1  NEEDLER1 CA      RCSFLAGS
 0342   REF  26  LAST  737   21,2416  7 6211 1           MASK    SIX
 0343                        21,2417  0 0006 1           EXTEND
 0344   REF   1              21,2420  1 2455 0           BZF     NEEDLES3
 0345   REF  30  LAST  982   21,2421  7 4710 1           MASK    BIT3
 0348                        21,2422  0 0008 1           EXTEND
 0347   REF   2  LAST  243   21,2423  1 2448 1           BZF     NEEDLER2    BIT3 = 0, BIT2 = 1

 0348   REF  37  LAST  975   21,2424  4 4705 0           CS      BIT8        FIRST PASS BIT3 = 1
 0349                        21,2425  0 0006 1           EXTEND              DISABLE IMU ERROR COUNTER TO ZERO DACS
 0350   REF  34  LAST  962   21,2426  03 012 1           WAND    CHAN12      MUST WAIT AT LEAST 60 MS BEFORE
 0351   REF 174  LAST  973   21,2427  4 4714 0  NEEDLE11 CS      ZERO        ENABLING COUNTERS.
 0352   REF  13  LAST  904   21,2430  55∝476 1           TS      AK          ZERO THE INPUTS ON FIRST PASS
 0353   REF   4  LAST  926   21,2431  55∝477 0           TS      AK1
 0354   REF   4  LAST  934   21,2432  55∝500 1           TS      AK2
 0355   REF   2  LAST  113   21,2433  55∝503 1           TS      EDRIVEX     ZERO THE DISPLAY REGISTERS
 0356   REF   2  LAST  113   21,2434  55∝504 0           TS      EDRIVEY
 0357   REF   2  LAST  113   21,2435  55∝505 1           TS      EDRIVEZ
 0358   REF   2  LAST  146   21,2436  54 050 0           TS      CDUXCMD     ZERO THE OUT COUNTERS
 0359   REF   2  LAST  146   21,2437  54 051 1           TS      CDUYCMD
 0360   REF   2  LAST  146   21,2440  54 052 1           TS      CDUZCMD
 0361   REF  29  LAST  982   21,2441  4 6211 1           CS      SIX         RESET RCSFLAGS FOR PASS2
 0362   REF  24  LAST  962   21,2442  7 1501 0           MASK    RCSFLAGS
 0363   REF  41  LAST  956   21,2443  6 4711 1           AD      BIT2
 0364   REF  25  LAST  962   21,2444  55∝501 0           TS      RCSFLAGS
 0365   REF 192  LAST  962   21,2445  0 0002 0           TC      Q           END PASS1

 0366   REF  36  LAST  962   21,2446  3 4705 1  NEEDLER2 CAF     BIT6        ENABLE IMU ERROR COUNTERS
 0367                        21,2447  0 0006 1           EXTEND
 0368   REF  35  LAST  962   21,2450  05 012 1           WOR     CHAN12
 0369   REF  30  LAST  982   21,2451  4 6211 1           CS      SIX         RESET RCSFLAGS TO DISPLAY ATTITUDE
```

```
0370  REP  26  LAST  982   21,2452  7 1501 0          MASK  RCSFLAGS     ERRORS   WAIT ATLEAST 4 MS FOR
0371  REP  27  LAST  983   21,2453  55=501 0          TS    RCSFLAGS     RELAY CLOSURE
0372  REP 193  LAST  982   21,2454  0 0002 0          TC    Q
0373  REP  39  LAST  982   21,2455  3 4705 1  NEEDLES3 CAF   BIT6         CHECK TO SEE IF IMU ERROR COUNTER
0374                        21,2456  0 0006 1          EXTEND             IS ENABLED
0375  REP  36  LAST  982   21,2457  02 012 0          RAND  CHAN12
0376                        21,2460  0 0006 1          EXTEND             IF NOT RECYCLE NEEDLES
0377  REP   8  LAST  980   21,2461  1 2411 0          BZF   NEEDLER +5

0378  REP  41  LAST  976   21,2462  3 4711 1  NEEDLES CAF   TWO
0379  REP  12  LAST  979   21,2463  55=506 1  DACLOOP TS    SPNDX
0380  REP   3  LAST  976   21,2464  4 4676 0          CS    QUARTER
0381                        21,2465  0 0006 1          EXTEND
0382  REP  13  LAST  983   21,2466  5 1506 0          INDEX SPNDX
0383  REP  14  LAST  982   21,2467  7 1476 1          MP    AK
0384  REP 121  LAST  969   21,2470  54 001 1          TS    L
0385  REP 223  LAST  978   21,2471  10 000 0          CCS   A
0386  REP   1               21,2472  3 2526 1          CA    DACLIMIT
0387                        21,2473  1 2475 1          TCF   +2
0388  REP   2  LAST  983   21,2474  4 2526 0          CS    DACLIMIT
0389  REP 122  LAST  983   21,2475  6 0001 0          AD    L
0390  REP   6  LAST  977   21,2476  55=502 0          TS    T5TEMP       OVFLO CHK
0391                        21,2477  1 2503 1          TCF   +4
0392  REP 224  LAST  983   21,2500  50 000 1          INDEX A            ON OVERFLOW LIMIT OUTPUT TO +-384
0393  REP   3  LAST  983   21,2501  3 2526 1          CAF   DACLIMIT
0394  REP 123  LAST  983   21,2502  54 001 1          TS    L
0395  REP  14  LAST  983   21,2503  51=506 0          INDEX SPNDX
0396  REP   3  LAST  982   21,2504  4 1503 1          CS    EDRIVEX      CURRENT VALUE OF DAC
0397  REP 124  LAST  983   21,2505  6 0001 0          AD    L
0398  REP  15  LAST  983   21,2506  51=506 0          INDEX SPNDX
0399  REP   3  LAST  982   21,2507  26 050 0          ADS   CDUXCMD
0400  REP  16  LAST  983   21,2510  51=506 0          INDEX SPNDX
0401  REP   4  LAST  983   21,2511  23=503 0          LXCH  EDRIVEX
0402  REP  17  LAST  983   21,2512  11=506 1          CCS   SPNDX
0403  REP   1               21,2513  1 2463 0          TCF   DACLOOP
0404  REP   4  LAST  568   21,2514  3 7707 0          CAF   13,14,15
0405                        21,2515  0 0006 1          EXTEND
0406  REP  11  LAST  948   21,2516  05 014 1          WOR   CHAN14       SET DAC ACTIVITY BITS
0407  REP 194  LAST  983   21,2517  0 0002 0          TC    Q

0408  REP   1               21,2520  3 2524 0  REINIT  CAF   DELAY200    .........TILT LOGIC
0409  REP  18  LAST  974   21,2521  54 030 0          TS    TIME5        REINITIALIZE DAP IN 200MS
0410  REP   7  LAST  974   21,2522  55=465 0          TS    T5PHASE
0411  REP  34  LAST  980   21,2523  1 5222 1          TCF   RESUME
0412                        21,2524   37754 0  DELAY200 DEC   16364      200MS
0413                        21,2525   77177 0          DEC   -364
```

```
0414                    21,2528   37200 1  DACLIMIT DEC    16000
0415                    21,2527   00600 1          DEC      384
```

P0416 INITIALIZATION PROGRAM FOR RCS-CSM AUTOPILOT

R0417 THE FOLLOWING QUANTITIES WILL BE ZEROED AND SHOULD APPEAR IN CONSECUTIVE LOCATIONS IN MEMORY AFTER WBODY

R0419	WBODY (+1)	DPT	TAU2	
R0420	WBODY1 (+1)	DPT1	BIAS	
R0421	WBODY2 (+1)	DPT2	BIAS1	
R0422	ADOT (+1)	DRHO (+1)	BIAS2	
R0423	ADOT1 (+1)	DRHO1 (+1)	ERRORX	
R0424	ADOT2 (+1)	DRHO2 (+1)	ERRORY	
R0425	MERRORX (+1)	ATTSEC	ERRORZ	
R0426	MERRORY (+1)	TAU		
R0427	MERRORZ (+1)	TAU1		

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 0428  REF 103  LAST  973   21,2530  3 4712 1  FRESHDAP CAF    ONE          RESET HOLDFLAG TO STOP AUTOMATIC
 0429  REF  10  LAST  978   21,2531  55=332 0            TS     HOLDFLAG     STEERING AND PREPARE TO PICK UP AN
A0430                                                                      ATTITUDE HOLD REFERENCE

 0431  REF  36  LAST  905   21,2532  0 4633 0  REDAP     TC     IBNKCALL     DECODE DAPDATR1, DAPDATR2 FOR DEADBANDS
 0432  REF   2  LAST  247   21,2533   40146 0            CADR   S41.2        RATES, QUADFAILS, QUAD MANAGEMENT

 0433  REF  37  LAST  985   21,2534  0 4633 0           TC     IBNKCALL     DECODE IXX, IAVG AND CONVERT
 0434  REF   2  LAST  248   21,2535   40277 1           CADR   S40.14       TO AUTOPILOT GAINS

 0436  REF   1              21,2536  3 2607 1           CAF    NO.TSVAR     NO. LOCATIONS TO BE ZEROED MINUS ONE
 0437  REF  18  LAST  983   21,2537  55=506 1  ZEROT5    TS     SPNDX        ZERO ALL NECESSARY ERASABLE REGISTERS
 0438  REF 175  LAST  982   21,2540  3 4714 1           CAF    ZERO
 0439  REF  19  LAST  985   21,2541  51=506 0           INDEX  SPNDX
 0440  REF  10  LAST  585   21,2542  55=525 0           TS     WBODY
 0441  REF  20  LAST  985   21,2543  11=506 1           CCS    SPNDX
 0442  REF   1              21,2544  1 2537 0           TCF    ZEROT5
 0443  REF   4  LAST  974   21,2545  0 2616 1           TCR    ZEROJET

 0444  REF 176  LAST  985   21,2546  4 4714 0           CS     ZERO
 0445  REF   2  LAST  107   21,2547  55=633 1           TS     CHANTEMP     INITIALIZE MINIMUM IMPULSE CONTROL

 04451 REF   2  LAST  107   21,2550  55=632 0           TS     CH31TEMP     INITIALIZE RHC POSITION MEMORY FOR
A04452                                                                     MANUAL RATE MODES
 0446  REF   1              21,2551  3 2610 1           CAF    =.24
 0447  REF   2  LAST  108   21,2552  55=654 0           TS     SLOPE        INITIALIZE SWITCHING LOGIC SLOPE

 0448  REF  11  LAST  906   21,2553  3 4710 0           CAF    FOUR
 0449  REF   3  LAST  974   21,2554  55=634 0           TS     T5TIME       PHASE 0 RESETS FOR PHASE 2 INTERRUPT IN
A0450                                                                      60MS. PHASE 2 RESETS FOR PHASE 1 RUPT
A04501                                                                     IN (80MS - T5TIME(40MS)). THEREFORE
A04502                                                                     PHASE 1 (RATEFILTER) BEGINS CYCLING 100
A04503                                                                     MS FROM NOW AND EVERY 100MS THEREAFTER

 0451  REF   5  LAST  784   21,2555  3 4717 1           CAF    ELEVEN
 0452  REF   4  LAST  977   21,2556  55=617 1           TS     ATTKALMN     RESET TO PICK UP KALMAN FILTER GAINS
A0453                                                                      TO INITIALIZE THE S/C ANGULAR RATES
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 0473   REF  21  LAST  976   21,2557   3 0032 0            CA    CDUX
 0474   REF   4  LAST  976   21,2560   55=635 1            TS    RHO
 0475   REF  12  LAST  976   21,2561   3 0033 1            CA    CDUY
 0476   REF   4  LAST  976   21,2562   55=636 1            TS    RHO1
 0477   REF  15  LAST  976   21,2563   3 0034 0            CA    CDUZ
 0478   REF   4  LAST  976   21,2564   55=637 0            TS    RHO2
 0479   REF 177  LAST  965   21,2565   3 4714 1            CAF   ZERO      RESET AUTOPILOT TO BEGIN EXECUTING
 0480   REF   6  LAST  963   21,2566   55=465 0            TS    T5PHASE   PHASE2 OF PROGRAM

 0481   REF  27  LAST  975   21,2567   4 1321 1            CS    IMODES33  CHECK IMU STATUS
 0482   REF  40  LAST  963   21,2570   7 4705 0            MASK  BIT8      IF BIT8 = 0 IMU IN FINE ALIGN
 0483   REF 225  LAST  963   21,2571   10 000 0            CCS   A         IF BIT8 = 1 IMU NOT READY
 0484   REF   1              21,2572   1 2576 0            TCF   IMUAOK
 0485   REF   5  LAST  985   21,2573   55=617 1            TS    ATTKALMN  CANNOT USE IMU
 0486   REF   1              21,2574   3 2612 0            CAF   RCS1NIT8  PROVIDE FREE CONTROL ONLY
 0487   REF   1              21,2575   1 2603 1            TCF   RCSSWIT   DONT START UP RATE FILTER
A0486                                                                     SIGNAL NO RATE FILTER

 0489   REF   6  LAST  977   21,2576   3 7671 0  IMUAOK    CAF   PRIO34    START MATRIX INITIALIZATION
 0490   REF  29  LAST  977   21,2577   0 5027 1            TC    NOVAC     BYPASS IF IMU NOT IN FINE ALIGN
 0491   REF  21  LAST  979   E6,1510                       EBANK= KMPAC
 0492   REF   2  LAST  977   21,2600   03444 0             2CADR AMBGUPDT
 0492                        21,2601   44066 1
 0493   REF   1              21,2602   3 2611 0            CAF   RCS1NIT   CLEAR BIT14 -ASSUME WE HAVE A GOOD IMU
 0494   REF  28  LAST  963   21,2603   55=501 0  RCSSWIT   TS    RCSFLAGS  CLEAR BIT1  -INITIALIZE T8 PROGRAM
A0495                                                                       SET BIT3  -INITIALIZE NEEDLES
A0496                                                                     CLEAR BIT4  -RESET FOR FDAIDSP1
 0497   REF   1              21,2604   3 2613 1            CAF   T5WAIT80  NEXT T5RUPT 80 MS FROM NOW TO ALLOW IMU
A0498                                                                     ERROR COUNTER TO ZERO.
A0499                                                                     (MINIMUM DELAY = 15 MS)
 0500   REF  19  LAST  963   21,2605   54 030 0            TS    TIME5     SINCE ATTKALMN IS +11, PROGRAM WILL THEN
 0501   REF  35  LAST  963   21,2606   0 5222 0            TC    RESUME    PICK UP THE KALMAN FILTER GAINS. RATE
A0502                                                                     FILTER WILL BEGIN OPERATING ZOOMS FROM
A0503                                                                     NOW

R0504  CONSTANTS USED IN INITIALIZATION PROGRAM

 0505                        21,2607   00044 1  NO.T5VAR  DEC   38
 0506                        21,2610   07534 1  =.24      DEC   .24        = SLOPE OF 0.6/SEC
 0507                        21,2611   00004 0  RCSINIT   OCT   00004
 0508                        21,2612   20004 1  RCSINIT8  OCT   20004
 0509                        21,2613   37772 1  T5WAIT80  DEC   16376      = 6 CS
 0510   REF  22  LAST  966   E6,1510                       EBANK= KMPAC
 0511   REF   1              21,2614   03644 1  T6ADDR    2CADR T6START
 0511   REF   1              21,2615   36066 1
053001  REF   6  LAST  985   21,2616   3 4717 1 ZEROJET   CAF   ELEVEN     ZERO BLAST2, BLAST1, BLAST, YWORD2,
053002  REF  21  LAST  965   21,2617   55=506 1            TS    SPNDX     YWORD1, PWORD2, PWORD1, RWORD2,
053003  REF 176  LAST  966   21,2620   3 4714 1            CAF   ZERO      AND RWORD1.
```

```
053004 REP  22 LAST 986  21,2621  51=506 0          INDEX  SPNDX
053005 REP   2 LAST 100  21,2622  55=451 1          TS     RWORD1
053006 REP  23 LAST 987  21,2623  11=506 1          CCS    SPNDX
053007 REP   5 LAST 985  21,2624  1 2617 1          TCF    ZEROJET +1

053008 REP  12 LAST 985  21,2625  3 4710 0          CAF    FOUR
053009 REP   2 LAST 100  21,2626  55=462 1          TS     BLAST1 +1
05301  REP   7 LAST 986  21,2627  3 4717 1          CAF    ELEVEN
0531   REP   2 LAST 100  21,2630  55=464 1          TS     BLAST2 +1

0532   REP  68 LAST 958  21,2631  4 4712 0          CS     BIT1
0533   REP  29 LAST 986  21,2632  7 1501 0          MASK   RCSFLAGS
0534   REP  30 LAST 987  21,2633  55=501 0          TS     RCSFLAGS      RESET BIT1 OF RCSFLAGS TO 0

0535                     21,2634  0 0006 1          EXTEND
0536   REP   1           21,2635  3 2615 1          DCA    T6ADDR
0537   REP   3 LAST 957  21,2636  53=311 1          DXCH   T6LOC
0538   REP   1           21,2637  3 3034 0          CAF    =+14MS        ENABLE T6RUPT TO SHUT OFF JETS IN 14 MS.
0539   REP   3 LAST 957  21,2640  54 031 1          TS     TIME6
0540   REP  41 LAST 973  21,2641  3 4674 0          CAF    BIT15
0541                     21,2642  0 0006 1          EXTEND
0542   REP   9 LAST 958  21,2643  05 013 0          WOR    CHAN13

0543   REP 195 LAST 983  21,2644  0 0002 0          TC     Q

0544   REP   6 LAST 986  21,2645  11=617 1  T5PHASE2 CCS    ATTKALMN      IF (+) INITIALIZE RATE ESTIMATE
0545   REP   1           21,2646  1 3132 0          TCF    KALUPDT
0546                     21,2647  1 2651 0          TCF    +2            ONLY IF ATTKALMN POSITIVE
0547                     21,2650  1 2651 0          TCF    +1
0548   REP   2 LAST 974  21,2651  3 2142 1          CA     DELTATT2      RESET FOR PHASE3 IN 20 MS
0549   REP  20 LAST 986  21,2652  56 030 1          XCH    TIME5         (JET SELECTION LOGIC )
0550   REP   4 LAST 985  21,2653  27=634 0          ADS    T5TIME        TO COMPENSATE FOR DELAYS IN T5RUPT
05501  REP  31 LAST 987  21,2654  3 1501 1          CA     RCSFLAGS      IF A HIGH RATE AUTO MANEUVER IS IN
05502  REP  42 LAST 987  21,2655  7 4674 1          MASK   BIT15         PROGRESS (BIT 15 OF RCSFLAGS SET), SET
05503                     21,2656  0 0006 1          EXTEND               ATTKALMN TO -1
05504  REP   1           21,2657  1 2661 0          BZF    NOHIAUTO      OTHERWISE SET ATTKALMN TO 0.
05505  REP 104 LAST 985  21,2660  4 4712 0          CS     ONE
05506  REP   7 LAST 987  21,2661  55=617 1 NOHIAUTO TS     ATTKALMN
```

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P0551                MANUAL ROTATION COMMANDS
 0552   REF   1                  21,2662  4 3016 1          CS     OCT01760     RESET FORCED FIRING BITS (BITS 10 TO 5
 0553   REF  32  LAST  987       21,2663  7 1501 0          MASK   RCSFLAGS     OF RCSFLAGS) TO ZERO
 0554   REF  33  LAST  966       21,2664  55«501 0          TS     RCSFLAGS

 0555                           21,2665  0 0006 1          EXTEND
 0556   REF   6  LAST  975       21,2666  00 031 0          READ   CHAN31
 0557   REF 125  LAST  983       21,2667  54 001 1          TS     L
 0558   REF   3  LAST  965       21,2670  3 1632 1          CA     CH31TEMP
 0559                           21,2671  0 0008 1          EXTEND
 0560   REF  11  LAST  945       21,2672  06 001 0          RXOR   LCHAN
 0561   REF   1                  21,2673  7 3022 0          MASK   MANROT       = OCT00077
 0562                           21,2674  0 0006 1          EXTEND
 0563   REF   1                  21,2675  6 2710 0          BZMP   NOCHANGE

 0564   REF 226  LAST  966       21,2678  22 000 1          LXCH   A
 0565   REF   4  LAST  986       21,2677  55«632 0          TS     CH31TEMP     SAVE CONTENTS OF CHANNEL 31 IN CH31TEMP

 0566   REF 126  LAST  988       21,2700  3 0001 0          CA     L
 0567                           21,2701  0 0006 1          EXTEND
 0568   REF  35  LAST  952       21,2702  7 4706 0          MP     BIT5         PUT BITS 6-1 OF A IN BITS 10-5 OF L
 0569   REF 127  LAST  966       21,2703  3 0001 0          CA     L
 0570   REF  34  LAST  966       21,2704  27«501 0          ADS    RCSFLAGS     SET FORCED FIRING BITS FOR AXES WITH
A0571                                                                          WITH CHANGES IN COMMAND. BITS 10,9 FOR
A0572                                                                          ROLL, BITS 6,7 FOR YAW, BITS 6,5 FOR
A0573                                                                          PITCH

 0574   REF  35  LAST  966       21,2705  4 1501 0          CS     RCSFLAGS     SET RATE DAMPING FLAGS (BITS 13,12,AND
 0575   REF   1                  21,2706  7 3023 1          MASK   OCT16000     11 OF RCSFLAGS)
 0576   REF  36  LAST  986       21,2707  27«501 0          ADS    RCSFLAGS

 0577   REF   5  LAST  968       21,2710  4 1632 0  NOCHANGE CS     CH31TEMP
 0578   REF   2  LAST  988       21,2711  7 3022 0          MASK   MANROT
 0579                           21,2712  0 0006 1          EXTEND
 0580   REF   1                  21,2713  6 3234 1          BZMP   AHFNOROT     IF NO MANUAL COMMANDS, GO TO AHFNOROT

 0581   REF  11  LAST  985       21,2714  55«332 0          TS     HOLDFLAG     SET HOLDFLAG +

 0582   REF   2  LAST  539       21,2715  0 3114 0          TC     STICKCHK     WHEN THE RHC IS OUT OF DETENT, PMANNDX,
A0583                                                                          YMANNDX, AND RMANNDX ARE ALL SET, BY
A0584                                                                          MEANS OF STICKCHK, TO 0, 1, OR 2 FOR NO,
A0585                                                                          +, OR - ROTATION RESPECTIVELY AS
A0588                                                                          COMMANDED BY THE RHC.

A0587                                                                          HOWEVER, IT IS WELL TO NOTE THAT AFTER
A0588                                                                          THE RHC IS RETURNED TO DETENT, THE
A0589                                                                          PROGRAM BRANCHES TO AHFNOROT AND AVOIDS
A0590                                                                          STICKCHK SO PMANNDX, YMANNDX, AND
A0591                                                                          RMANNDX ARE NOT RESET TO ZERO BUT RATHER
A0592                                                                          LEFT SET TO THEIR LAST OUT OF DETENT
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A0593                                                                   VALUES.

 0594   REF  22  LAST  779   21,2716  4 0075 1        CS     FLAGWRD1    SET STIKFLAG TO INFORM STEERING
 0595   REF  56  LAST  975   21,2717  7 4675 0        MASK   BIT14      PROGRAMS (P20) THAT ASTRONAUT HAS
 0596   REF  23  LAST  989   21,2720  26 075 1        ADS    FLAGWRD1    ASSUMED ROTATIONAL CONTROL OF SPACECRAFT

 0597   REF  57  LAST  989   21,2721  3 4675 1        CAF    BIT14
 0598                        21,2722  0 0008 1        EXTEND
 0599   REF   9  LAST  988   21,2723  02 031 1        RAND   CHAN31
 0600                        21,2724  0 0008 1        EXTEND
 0601   REF   1               21,2725  6 3035 1        BZMF   FREEFUNC

 0602   REF  37  LAST  988   21,2726  3 1501 1        CA     RCSFLAGS    EXAMINE RCSFLAGS TO SEE IF RATE FILTER
 0603   REF  58  LAST  989   21,2727  7 4675 0        MASK   BIT14      HAS BEEN INITIALIZED
 0604   REF 227  LAST  988   21,2730  10 000 0        CCS    A           IF SO, PROCEED WITH MANUAL RATE COMMANDS
 0605   REF   2  LAST  975   21,2731  1 2520 0        TCF    REINIT      .....TILT, RECYCLE TO INITIALIZE FILTER

 0606   REF  24  LAST  960   21,2732  4 4715 1        CS     FIVE        IF MANUAL MANEUVER IS AT HIGH RATE, SET
 0607   REF   5  LAST  688   21,2733  6 1130 1        AD     RATEINDX    ATTKALMN TO -1.
 0608                        21,2734  0 0006 1        EXTEND             OTHERWISE, LEAVE ATTKALMN ALONE.
 0609                        21,2735  6 2740 0        BZMF   +3
 0610   REF 105  LAST  987   21,2738  4 4712 0        CS     ONE
 0611   REF   8  LAST  987   21,2737  55#817 1        TS     ATTKALMN
 0614   REF  42  LAST  983   21,2740  3 4711 1        CAF    TWO         AUTO-HOLD MANUAL ROTATION
 0615   REF  24  LAST  987   21,2741  55#506 1  SETWBODY TS     SPNDX
 0616                        21,2742  6 0000 1        DOUBLE
 0617   REF  18  LAST  979   21,2743  55#507 0        TS     DPNDX
 0618   REF  25  LAST  989   21,2744  51#506 0        INDEX  SPNDX       RMANNDX = 0 NO ROTATION
 0619   REF   3  LAST  539   21,2745  3 1656 0        CA     RMANNDX             = 1  + ROTATION
 0620                        21,2746  0 0006 1        EXTEND             = 2  - ROTATION
 0621   REF   1               21,2747  1 2771 0        BZF    NORATE      IF NO ROTATION COMMAND ON THIS AXIS,
A0622                                                                   GO TO NORATE.

 0623   REF   6  LAST  989   21,2750  6 1130 1        AD     RATEINDX    RATEINDX = 0  0.05 DEG/SEC
 0624   REF 196  LAST  987   21,2751  54 002 1        TS     Q                    = 2  0.2 DEG/SEC
 0625   REF 197  LAST  989   21,2752  50 002 0        INDEX  Q                    = 4  0.5 DEG/SEC
 0626   REF   1               21,2753  3 3023 0        CA     MANTABLE -1          = 8  4.0 DEG/SEC
 0627                        21,2754  0 0008 1        EXTEND
 0628   REF  29  LAST  783   21,2755  7 4702 1        MP     BIT9        MULTIPLY MANTABLE BY 2 TO THE -6
 0629   REF  19  LAST  989   21,2758  51#507 1        INDEX  DPNDX       TO GET COMMANDED RATE.
 0630   REF  11  LAST  985   21,2757  53#526 0        DXCH   WBODY       SET WBODY TO COMMANDED RATE.

 0631   REF  38  LAST  989   21,2760  3 1501 1        CA     RCSFLAGS
 0632   REF   2  LAST  988   21,2761  7 3023 1        MASK   OCT16000    IS RATE DAMPING COMPLETED (BITS 13,12AND
 0633                        21,2762  0 0006 1        EXTEND             11 OF RCSFLAGS ALL ZERO.) IF SO, GO TO
 0634   REF   1               21,2763  1 3001 1        BZF    MERUPDAT    MERUPDAT TO UPDATE CUMULATIVE ATTITUDE
A0835                                                                   ERROR.
```

```
0636  REF 179  LAST 988   21,2764  3 4714 1  ZEROER   CA    ZERO      ZEROER ZEROS MERRORS
0637                      21,2765  22 007 0            ZL
0638  REF  20  LAST 989   21,2786  51«507 1            INDEX DPNDX
0639  REF   3  LAST 977   21,2787  53«542 1            DXCH  MERRORX
0640  REF   1            21,2770  1 3007 1            TCF   SPNDXCHK

0641                      21,2771  22 007 0  NORATE    ZL
0642  REF  21  LAST 990   21,2772  51«507 1            INDEX DPNDX
0643  REF  12  LAST 989   21,2773  53«526 0            DXCH  WBODY       ZERO WBODY FOR THIS AXIS
0644  REF  39  LAST 969   21,2774  3 1501 1            CA    RCSFLAGS
0645  REF   3  LAST 989   21,2775  7 3023 1            MASK  OCT18000
0646                      21,2778  0 0006 1            EXTEND            IS RATE DAMPING COMPLETED
0647  REF   2  LAST 990   21,2777  1 3007 1            BZF   SPNDXCHK    YES, KEEP CURRENT MERRORX GO TO SPNDXCHK
0648  REF   1            21,3000  1 2784 1            TCF   ZEROER      NO,GO TO ZEROER

0649  REF 196  LAST 969   21,3001  50 002 0  MERUPDAT  INDEX 0           MERRORX=MERRORX+MEASURED CHANGE IN ANGLE
0650  REF   2  LAST 989   21,3002  4 3023 1            CS    MANTABLE -1 -COMMANDED CHANGE IN ANGLE
0651                      21,3003  0 0006 1            EXTEND            THE ADDITION OF MEASURED CHANGE IN ANGLE
0652  REF  43  LAST 784   21,3004  7 4704 1            MP    BIT7        HAS ALREADY BEEN DONE IN THE RATE FILTER
0653  REF  22  LAST 990   21,3005  51«507 1            INDEX DPNDX       COMMANDED CHANGE IN ANGLE = WBODY TIMES
0654  REF   4  LAST 990   21,3008  21«542 1            DAS   MERRORX     .1SEC = MANTABLE ENTRY TIMES 2 TO THE -6

0655  REF  23  LAST 990   21,3007  51«507 1  SPNDXCHK  INDEX DPNDX
0656  REF   5  LAST 990   21,3010  3 1541 0            CA    MERRORX
0657  REF  26  LAST 989   21,3011  51«506 0            INDEX SPNDX
0658  REF   6  LAST 973   21,3012  55«567 0            TS    ERRORX      ERRORX = HIGH ORDER WORD OF MERRORX
0659  REF  27  LAST 990   21,3013  11«506 1            CCS   SPNDX
0660  REF   1            21,3014  1 2741 0            TCF   SETWBODY
0661  REF   1            21,3015  1 3425 0            TCF   JETS
0662                      21,3016   01760 1  OCT01760 OCT   01760       FORCED FIRING BITS MASK

0663                      21,3017   01400 1  OCT01400 OCT   01400       ROLL FORCED FIRING MASK     ORDER OF
0664                      21,3020   00060 1  OCT00060 OCT   00060       PITCH FORCED FIRING MASK    DEFINITION
0665                      21,3021   00300 1  OCT00300 OCT   00300       YAW FORCED FIRING MASK      MUST BE
A0666                                                                                             PRESERVED
A0667                                                                                           FOR INDEXING
0668                      21,3022   00077 1  MANROT   OCT   77
0669                      21,3023   16000 0  OCT16000 OCT   16000       RATE DAMPING FLAGS MASK
0670                      21,3024   00165 0  MANTABLE DEC   .0071111
0671                      21,3025   77612 1            DEC   -.0071111
0672                      21,3026   00722 0            DEC   .028444
0673                      21,3027   77055 1            DEC   -.028444
0674                      21,3030   02215 0            DEC   .071111
0675                      21,3031   75562 1            DEC   -.071111
0676                      21,3032   22151 1            DEC   .568889
0677                      21,3033   55626 0            DEC   -.568889
0676                      21,3034   00027 1  =+14MS   DEC   23
0679  REF   4  LAST 969   21,3035  51«656 0  FREEFUNC  INDEX RMANNDX     ACCELERATION
```

```
0680  REF   1                 21,3036  3 3047 1          CA    FREETAU     COMMANDS
0681  REF   2  LAST  107      21,3037  55=561 0          TS    TAU
0682  REF   3  LAST  540      21,3040  51=657 1          INDEX PMANNDX
0683  REF   2  LAST  991      21,3041  3 3047 1          CA    FREETAU     FREETAU    0 SEC
0684  REF   2  LAST  107      21,3042  55=562 0          TS    TAU1        +1       +0.10 SEC
0685  REF   3  LAST  540      21,3043  51=660 0          INDEX YMANNDX     +2       -0.10 SEC
0686  REF   3  LAST  991      21,3044  3 3047 1          CA    FREETAU     (+3)       0 SEC
0687  REF   2  LAST  107      21,3045  55=563 1          TS    TAU2
0688  REF   1                 21,3046  1 3053 0          TCF   T6PROGM

0689                          21,3047   00000 1 FREETAU  DEC   0
0690                          21,3050   00740 1          DEC   480
0691                          21,3051   77037 0          DEC   -480
0692                          21,3052   00000 1          DEC   0

0693  REF 180  LAST  990      21,3053  3 4714 1 T6PROGM  CAF   ZERO        FOR MANUAL ROTATIONS
0694  REF   7  LAST  990      21,3054  55=567 0          TS    ERRORX
0695  REF   4  LAST  973      21,3055  55=570 0          TS    ERRORY
0696  REF   3  LAST  973      21,3056  55=571 1          TS    ERRORZ
0697  REF   1                 21,3057  1 3743 0          TCF   T6PROG
```

```
 06975                          21,3060  06604 0          DEC     .2112      FILTER GAIN FOR TRANSLATION, LEM ON
 0696                           21,3061  32703 1          DEC     .6400      FILTER GAIN FOR TRANSLATION 2(ZETA)WN DT
 0699                           21,3062  06604 0          DEC     .2112      FILTER GAIN FOR 4 DEGREE/SEC MANEUVERS
 0700                           21,3063  02031 1 GAIN1    DEC     .0640      KALMAN FILTER GAINS FOR INITIALIZATION
 0701                           21,3064  12132 1          DEC     .3160      OF ATTITUDE RATES
 0702                           21,3065  13030 0          DEC     .3452
 0703                           21,3066  14047 1          DEC     .3774
 0704                           21,3067  15241 1          DEC     .4161
 0705                           21,3070  16650 0          DEC     .4634
 0706                           21,3071  20555 0          DEC     .5223
 0707                           21,3072  23065 0          DEC     .5970
 0708                           21,3073  26137 0          DEC     .6933
 0709                           21,3074  32053 0          DEC     .6151
 0710                           21,3075  35712 0          DEC     .9342

 07105                          21,3076  00435 0          DEC     .0174      FILTER GAIN FOR TRANSLATION, LEM ON
 0711                           21,3077  13412 1          DEC     .3600      FILTER GAIN FOR TRANSLATION (WN)(WN)DT
 0712                           21,3100  00435 0          DEC     .0174      FILTER GAIN FOR  4 DEGREE/SEC MANEUVERS
 0713                           21,3101  00032 0 GAIN2    DEC     .001E      SCALED 10
 0714                           21,3102  01350 0          DEC     .0454
 0715                           21,3103  01575 1          DEC     .0545
 0716                           21,3104  02103 1          DEC     .0666
 0717                           21,3105  02523 1          DEC     .0632
 0716                           21,3106  03327 1          DEC     .1069
 0719                           21,3107  04432 0          DEC     .1422
 0720                           21,3110  06264 1          DEC     .1965
 0721                           21,3111  11351 0          DEC     .2955
 0722                           21,3112  17324 1          DEC     .4817
 0723                           21,3113  33622 1          DEC     .6663
 0724  REF   7  LAST  963      21,3114  55K502 0 STICKCHK TS      TSTEMP
 0725  REF  26  LAST  904      21,3115  7 6214 1          MASK    THREE      INDECES FOR MANUAL ROTATION
 0726  REF   4  LAST  991      21,3116  55K657 0          TS      PMANNDX
 0727  REF   6  LAST  992      21,3117  3 1502 1          CA      TSTEMP
 0726                          21,3120  0 0006 1          EXTEND             MAN RATE 0   0 RATE (DP)
 0729  REF   4  LAST  963      21,3121  7 4676 0          MP      QUARTER            +1   +RATE (DP)
 0730  REF   9  LAST  992      21,3122  55K502 0          TS      TSTEMP             +2   -RATE (DP)
 0731  REF  29  LAST  992      21,3123  7 6214 1          MASK    THREE            (+3)  0 RATE (DP)
 0732  REF   4  LAST  991      21,3124  55K660 1          TS      YMANNDX                .
 0733  REF  10  LAST  992      21,3125  3 1502 1          CA      TSTEMP
 0734                          21,3126  0 0006 1          EXTEND
 0735  REF   5  LAST  992      21,3127  7 4676 0          MP      QUARTER
 0736  REF   5  LAST  990      21,3130  55K656 1          TS      RMANNDX
 0737  REF 199  LAST  990      21,3131  0 0002 0          TC      0
 0736  REF   9  LAST  969      21,3132  55K617 1 KALUPDT  TS      ATTKALMN   INITIALIZATION OF ATTITUDE RATES USING
A0739                                                                        KALMAN FILTER TAKES 1.1 SEC

 0740  REF   1                 21,3133  3 2141 1          CA      DELTATT    =1SEC - 60MS
 0741  REF   5  LAST  987      21,3134  6 1634 1          AD      TSTIME     + DELAYS
```

```
0742  REF  21  LAST  967   21,3135  54 030 0          TS    TIME5
0743                       21,3136  1 3141 1          TCF   +3
0744  REF   3  LAST  967   21,3137  3 2142 1          CAF   DELTATT2     SAFETY PLAY TO ASSURE
0745  REF  22  LAST  993   21,3140  54 030 0          TS    TIME5        A T5RUPT
0752  REF 161  LAST  991   21,3141  4 4714 0  KRESUME2 CS    ZERO         RESET FOR PHASE1
0753  REF   9  LAST  966   21,3142  55"465 0          TS    T5PHASE      RESUME INTERRUPTED PROGRAM
0754  REF  36  LAST  966   21,3143  1 5222 1          TCF   RESUME
0755  REF  34  LAST  962   21,3144  4 4707 1  FDAIDSP2 CS    BIT4         RESET FOR FDAIDSP1
0756  REF  40  LAST  990   21,3145  7 1501 0          MASK  RCSFLAGS
0757  REF  41  LAST  993   21,3146  55"501 0          TS    RCSFLAGS

0758  REF  11  LAST  764   21,3147  4 0074 0          CS    FLAGWRD0     ON - DISPLAY ONE OF THE TOTAL ATTITUDE
0759  REF  30  LAST  969   21,3150  7 4702 1          MASK  BIT9         ERRORS
0760                       21,3151  0 0006 1          EXTEND
0761  REF   1              21,3152  1 3161 0          BZF   FDAITOTL
0762                       21,3153  0 0006 1          EXTEND
0763  REF   6  LAST  991   21,3154  4 1570 0          DCS   ERRORX       OFF -DISPLAY AUTOPILOT FOLLOWING ERROR
0764  REF  15  LAST  963   21,3155  53"477 0          DXCH  AK
0765  REF   4  LAST  991   21,3156  4 1571 1          CS    ERRORZ
0766  REF   5  LAST  962   21,3157  55"500 1          TS    AK2
0767  REF  37  LAST  993   21,3160  1 5222 1          TCF   RESUME       END PHASE 1
0768  REF  14  LAST  906   21,3161  3 0105 0  FDAITOTL CA    FLAGWRD9
07661 REF  41  LAST  966   21,3162  7 4705 0          MASK  BIT6
07662                      21,3163  0 0006 1          EXTEND
07663 REF   1              21,3164  1 3227 1          BZF   WRTN17       IS N22ORN17 (BIT6 OF FLAGWRD9) = 0
A07664                                                                  IF SO, GO TO WRTN17
07665                      21,3165  0 0006 1  WRTN22  EXTEND             OTHERWISE, CONTINUE ON TO WRTN22 AND
0769  REF   2  LAST  412   21,3166  3 1157 0          DCA   CTHETA       GET SET TO COMPUTE TOTAL ATTITUDE
0770  REF   2  LAST  106   21,3167  53"514 1          DXCH  WTEMP        ERROR WRT N22 BY PICKING UP THE THREE
0771  REF   9  LAST  566   21,3170  3 1155 1          CA    CPHI         COMPONENTS OF N22

0772                       21,3171  0 0006 1  GETAKS   EXTEND           COMPUTE TOTAL ATTITUDE ERROR FOR
0773  REF  22  LAST  966   21,3172  20 032 1          MSU   CDUX         DISPLAY ON FDAI ERROR NEEDLES
0774  REF  16  LAST  993   21,3173  55"476 1          TS    AK
0775  REF   3  LAST  993   21,3174  3 1513 1          CA    WTEMP
0776                       21,3175  0 0006 1          EXTEND
0777  REF  13  LAST  966   21,3176  20 033 0          MSU   CDUY
0778  REF  11  LAST  992   21,3177  55"502 0          TS    T5TEMP
0779                       21,3200  0 0006 1          EXTEND
0780  REF   3  LAST  976   21,3201  7 1640 0          MP    AMGB1
0781  REF  17  LAST  993   21,3202  27"476 1          ADS   AK
0782  REF  12  LAST  993   21,3203  3 1502 1          CA    T5TEMP
0783                       21,3204  0 0006 1          EXTEND
0784  REF   3  LAST  976   21,3205  7 1641 1          MP    AMGB4
```

```
0785  REF   5  LAST  982   21,3208  55∝477 0          TS      AK1
0786  REF  13  LAST  993   21,3207  3 1502 1          CA      T5TEMP
0787                       21,3210  0 0008 1          EXTEND
0788  REF   3  LAST  978   21,3211  7 1643 0          MP      AMGB7
0789  REF   6  LAST  993   21,3212  55∝500 1          TS      AK2
0790  REF   4  LAST  993   21,3213  3 1514 0          CA      WTEMP +1
0791                       21,3214  0 0008 1          EXTEND
0792  REF  18  LAST  988   21,3215  20 034 1          MSU     CDUZ
0793  REF  14  LAST  994   21,3218  55∝502 0          TS      T5TEMP
0794                       21,3217  0 0008 1          EXTEND
0795  REF   3  LAST  978   21,3220  7 1842 1          MP      AMGB5
0798  REF   8  LAST  994   21,3221  27∝477 0          ADS     AK1
0797  REF  15  LAST  994   21,3222  3 1502 1          CA      T5TEMP
0798                       21,3223  0 0008 1          EXTEND
0799  REF   3  LAST  978   21,3224  7 1844 1          MP      AMGB8
0800  REF   7  LAST  994   21,3225  27∝500 1          ADS     AK2
0801  REF  38  LAST  993   21,3228  1 5222 1          TCF     RESUME      END PHASE1 OF RCS DAP

0802                       21,3227  0 0008 1  WRTN17  EXTEND
0803  REF   9  LAST  587   21,3230  3 1335 0          DCA     CPHIX +1    GET SET TO COMPUTE TOTAL ASTRONAUT
0804  REF   5  LAST  994   21,3231  53∝514 1          DXCH    WTEMP       ATTITUDE ERROR WRT N17 BY PICKING UP
0805  REF  10  LAST  994   21,3232  3 1333 0          CA      CPHIX       THE THREE COMPONENTS OF N17
0808  REF   1               21,3233  1 3171 1          TCF     GETAKS
```

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```
0001                          21,3234                    BANK    21
0002  REF   3  LAST  973      21,2000                    SETLOC  DAPS3
0003                          21,3234                    BANK

0004  REF   1                                            COUNT   21/DAPAM

0005  REF  23  LAST  966      E6,1510                    EBANK=  KMPAC
0006                          21,3234  0 0006 1  AHPNOROT EXTEND
0007  REF  10  LAST  989      21,3235  00 031 0          READ    CHAN31
0008  REF  59  LAST  969      21,3236  7 4675 0          MASK    BIT14
0009                          21,3237  0 0006 1          EXTEND
0010  REF   1                 21,3240  6 3256 0          BZMF    FREECONT
0011  REF  42  LAST  993      21,3241  3 1501 1          CA      RCSFLAGS
0012  REF  60  LAST  996      21,3242  7 4675 0          MASK    BIT14
0013  REF 226  LAST  969      21,3243  10 000 0          CCS     A
0014  REF   3  LAST  969      21,3244  1 2520 0          TCF     REINIT
A0015
0016                          21,3245  0 0006 1          EXTEND
0017  REF  11  LAST  996      21,3246  00 031 0          READ    CHAN31
0018  REF  39  LAST  941      21,3247  7 4676 0          MASK    BIT13
0019                          21,3250  0 0006 1          EXTEND
0020  REF   1                 21,3251  6 3356 1          BZMF    HOLDFUNC
0021  REF  12  LAST  966      21,3252  3 1332 1  AUTOCONT CA      HOLDFLAG
0022                          21,3253  0 0006 1          EXTEND
0023  REF   1                 21,3254  6 3306 1          BZMF    ATTHOLD
0024  REF   1                 21,3255  1 3362 1          TCF     GRABANG

R0026          MINIMUM IMPULSE CONTROL

0027  REF 106  LAST  969      21,3256  3 4712 1  FREECONT CAF     ONE
0028  REF  13  LAST  996      21,3257  55=332 0          TS      HOLDFLAG
A0029
0030                          21,3260  0 0006 1          EXTEND
0031  REF   2  LAST  132      21,3261  00 032 0          READ    CHAN32
0032  REF 126  LAST  966      21,3262  54 001 1          TS      L
0033                          21,3263  4 0000 0          COM
0034  REF   3  LAST  966      21,3264  7 3022 0          MASK    MANROT
0035  REF   3  LAST  965      21,3265  7 1633 1          MASK    CHANTEMP
0036  REF   4  LAST  996      21,3266  23=633 0          LXCH    CHANTEMP
0037  REF   3  LAST  966      21,3267  0 3114 0          TC      STICKCHK
0038  REF   6  LAST  992      21,3270  51=656 0          INDEX   RMANNDX
0039  REF   1                 21,3271  3 3302 0          CA      MINTAU
0040  REF   3  LAST  991      21,3272  55=561 0          TS      TAU
0041  REF   5  LAST  992      21,3273  51=657 1          INDEX   PMANNDX
0042  REF   2  LAST  996      21,3274  3 3302 0          CA      MINTAU
0043  REF   3  LAST  991      21,3275  55=562 0          TS      TAU1
0044  REF   5  LAST  992      21,3276  51=660 0          INDEX   YMANNDX
0045  REF   3  LAST  996      21,3277  3 3302 0          CA      MINTAU
```

SEE IF RATE FILTER HAS BEEN INITIALIZED

IF SO, PROCEED WITH ATTITUDE CONTROL
IF NOT, RECYCLE TO INITIALIZE FILTER
AUTOMATIC CONTROL YET

IF HOLDFLAG IS +, GO TO GRABANG.
OTHERWISE, GO TO ATTHOLD.

RESET HOLDFLAG
INHIBIT AUTOMATIC STEERING

```
MINTAU  +0
          +1   +14MS MINIMUM IMPULSE
          +2   -14MS TIME
          +3   +0
```

```
0046  REP  3 LAST  991    21,3300  55«563 1          TS    TAU2
0047  REP  2 LAST  991    21,3301  1 3053 0          TCF   T6PROGM
0048                      21,3302   00000 1  MINTAU  DEC   0
0049                      21,3303   00027 1          DEC   23        = 14MS
0050                      21,3304   77750 0          DEC   -23       = -14MS
0051                      21,3305   00000 1          DEC   0
```

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P0052 CALCULATION OF ATTITUDE ERRORS-

R0053 $\bar{\ }$ * $\bar{\ }$ $\bar{\ }$ $\bar{\ }$
R0054 $\bar{A}K = AMGB\ (CDUX - THETADX) + BIAS$

R0055 1E *AK * * 1 SIN(PSI) 0 ** CDUX - THETADX * *BIAS *
R0057 * * * ** * * *
R0059 *AK_1* = * 0 COS(PSI)COS(PHI) SIN(PHI)** CDUY - THETADY * + *$BIAS_1$*
R0061 * * * ** * * *
R0063 *AK_2* * 0 -COS(PSI)SIN(PHI) COS(PHI)** CDUZ - THETADZ * *$BIAS_2$*
R0065 THE BIASES ARE ADDED ONLY WHILE PERFORMING AUTOMATIC MANEUVERS (ESP KALCMANU) TO PROVIDE ADDITIONAL LEAD
R0067 AND PREVENT OVERSHOOT WHEN STARTING AN AUTOMATIC MANEUVER. NORMALLY THE REQUIRED LEAD IS ONLY 1-2 DEGREES.
R0069 BUT DURING HIGH RATE MANEUVERS IT CAN BE AS MUCH AS 7 DEGREES. THE BIASES ARE COMPUTED BY KALCMANU AND REMAIN
R0071 FIXED UNTIL THE MANEUVER IS COMPLETED AT WHICH TIME THEY ARE RESET TO ZERO.

```
0075  REF  23  LAST  993   21,3306  3 0032 0  ATTHOLD  CA      CDUX
0076                       21,3307  0 0006 1           EXTEND
0077  REF   6  LAST  979   21,3310  21∝572 1           MSU     THETADX
0078  REF   9  LAST  993   21,3311  55∝567 0           TS      ERRORX
0079  REF  14  LAST  993   21,3312  3 0033 1           CA      CDUY
0060                       21,3313  0 0006 1           EXTEND
0081  REF   3  LAST  643   21,3314  21∝573 0           MSU     THETADY
0082  REF  16  LAST  994   21,3315  55∝502 0           TS      T5TEMP
0063                       21,3316  0 0006 1           EXTEND
0084  REF   4  LAST  993   21,3317  7 1640 0           MP      AMGB1
0085  REF  10  LAST  998   21,3320  27∝567 0           ADS     ERRORX
0068  REF  17  LAST  998   21,3321  3 1502 1           CA      T5TEMP
0067                       21,3322  0 0006 1           EXTEND
0088  REF   4  LAST  993   21,3323  7 1641 1           MP      AMGB4
0089  REF   5  LAST  991   21,3324  55∝570 0           TS      ERRORY
0090  REF  16  LAST  998   21,3325  3 1502 1           CA      T5TEMP
0091                       21,3326  0 0006 1           EXTEND
0092  REF   4  LAST  994   21,3327  7 1643 0           MP      AMGB7
0093  REF   5  LAST  993   21,3330  55∝571 1           TS      ERRORZ
0094  REF  17  LAST  994   21,3331  3 0034 0           CA      CDUZ
0095                       21,3332  0 0006 1           EXTEND
0096  REF   3  LAST  114   21,3333  21∝574 1           MSU     THETADZ
0097  REF  19  LAST  998   21,3334  55∝502 0           TS      T5TEMP
0098                       21,3335  0 0006 1           EXTEND
0099  REF   4  LAST  994   21,3336  7 1642 1           MP      AMGB5
0100  REF   6  LAST  998   21,3337  27∝570 0           ADS     ERRORY
0101  REF  20  LAST  998   21,3340  3 1502 1           CA      T5TEMP
0102                       21,3341  0 0006 1           EXTEND
0103  REF   4  LAST  994   21,3342  7 1644 1           MP      AMGB6
0104  REF   6  LAST  996   21,3343  27∝571 1           ADS     ERRORZ
0105  REF  14  LAST  996   21,3344  4 1332 0           CS      HOLDFLAG
0106                       21,3345  0 0006 1           EXTEND
```

```
0107  REF   2  LAST  990  21,3346  6 3425 1          BZMF  JETS
0108  REF   4  LAST  411  21,3347  3 1564 1          CA    BIAS      AD BIASES ONLY IF PERFORMING AUTOMATIC
0109  REF  11  LAST  998  21,3350  27=587 0          ADS   ERRORX
0110  REF   4  LAST  411  21,3351  3 1585 0          CA    BIAS1
0111  REF   7  LAST  998  21,3352  27=570 0          ADS   ERRORY
0112  REF   4  LAST  411  21,3353  3 1568 0          CA    BIAS2
0113  REF   7  LAST  998  21,3354  27=571 1          ADS   ERRORZ
0114  REF   3  LAST  999  21,3355  1 3425 0          TCF   JETS
0115  REF  15  LAST  998  21,3356  11=332 0 HOLDFUNC CCS   HOLDFLAG
0116                      21,3357  1 3382 1          TCF   +3
0117  REF   2  LAST  998  21,3360  1 3306 0          TCF   ATTHOLD
0118                      21,3361  1 3382 1          TCF   +1
0119  REF 182  LAST  993  21,3362  3 4714 1 GRABANG  CAF   ZERO      ZERO WBODYS AND BIASES
01191 REF  13  LAST  990  21,3363  55=525 0          TS    WBODY
01192 REF  14  LAST  999  21,3364  55=526 0          TS    WBODY +1
01193 REF   5  LAST  585  21,3365  55=527 1          TS    WBODY1
01194 REF   6  LAST  999  21,3368  55=530 1          TS    WBODY1 +1
01195 REF   6  LAST  585  21,3367  55=531 0          TS    WBODY2
01196 REF   7  LAST  999  21,3370  55=532 0          TS    WBODY2 +1
01197 REF   5  LAST  999  21,3371  55=564 0          TS    BIAS
01198 REF   5  LAST  999  21,3372  55=565 1          TS    BIAS1
01199 REF   5  LAST  999  21,3373  55=566 1          TS    BIAS2

0120  REF  43  LAST  996  21,3374  3 1501 1          CA    RCSFLAGS
01201 REF   4  LAST  990  21,3375  7 3023 1          MASK  OCT16000
012011                    21,3378  0 0008 1          EXTEND            IS RATE DAMPING COMPLETED
01202 REF   1              21,3377  1 3405 1          BZF   ENDDAMP     IF SO, GO TO ENDDAMP
01203 REF 183  LAST  999  21,3400  3 4714 1          CAF   ZERO        OTHERWISE, ZERO ERRORS
01204 REF  12  LAST  999  21,3401  55=567 0          TS    ERRORX
01205 REF   8  LAST  999  21,3402  55=570 0          TS    ERRORY
01206 REF   8  LAST  999  21,3403  55=571 1          TS    ERRORZ
01207 REF   4  LAST  999  21,3404  1 3425 0          TCF   JETS

01208 REF  16  LAST  999  21,3405  55=332 0 ENDDAMP  TS    HOLDFLAG  SET HOLDFLAG +0,
01209                     21,3406  0 0008 1          EXTEND
0121  REF  24  LAST  998  21,3407  3 0033 1          DCA   CDUX      PICK UP CDU ANGLES FOR ATTITUDE HOLD
01211 REF   7  LAST  998  21,3410  53=573 0          DXCH  THETADX   REFERENCES
01212 REF  18  LAST  998  21,3411  3 0034 0          CA    CDUZ
01213 REF   4  LAST  998  21,3412  55=574 1          TS    THETADZ
01214 REF   3  LAST  999  21,3413  1 3308 0          TCF   ATTHOLD
```

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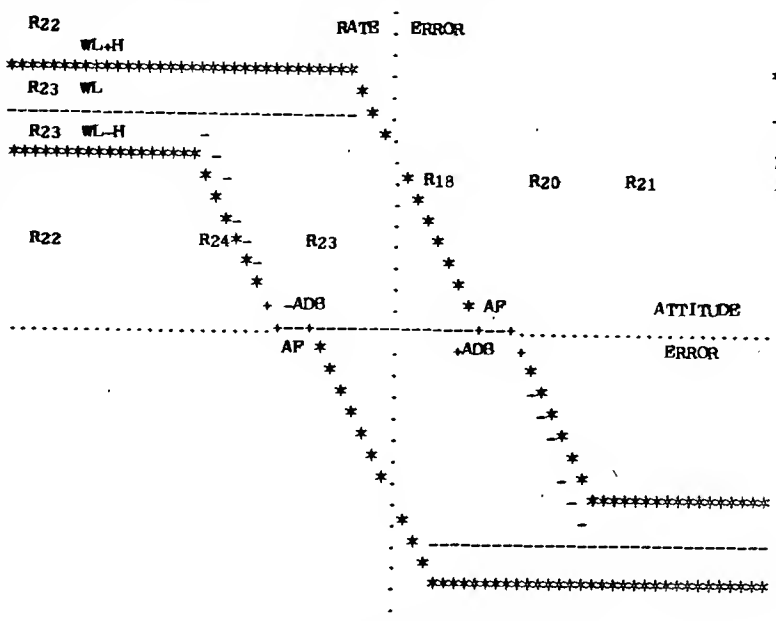
P0130 JET SWITCHING LOGIC AND CALCULATION OF REQUIRED ROTATION COMMANDS

R0131 DETERMINE THE LOCATION OF THE RATE ERROR AND THE ATTITUDE ERROR RELATIVE TO THE SWITCHING LOGIC IN THE PHASE
R0133 PLANE.
R0134 COMPUTE THE CHANGE IN RATE CORRESPONDING TO THE ATTITUDE ERROR NECESSARY TO DRIVE THE THE S/C INTO THE
R0138 APPROPRIATE DEADZONE.



***** SWITCH LINES ENCLOSING DEADZONES

----- DESIRED RATE LINES

R20, R21, R22, ETC REGIONS IN PHASE PLANE FOR COMPUTING DESIRED RESPONSE

R0170 FIG. 1 PHASE PLANE SWITCHING LOGIC
R0171 CONSTANTS FOR JET SWITCHING LOGIC

```
0172    21,3414  00114 0  WLH/SLOP DEC    .00483        = WL+H/SLOPE = .83333 DEG     $180
0173    21,3415  00055 1  WL-H/SLP DEC    .00277        = WL-H/SLOPE = .5 DEG         $180
0174    21,3416  00022 1  WLH       2DEC   .0011111111   = WL+H = 0.5 DEG/SEC          $450
0174    21,3417  08426 1
0175    21,3420  00012 1  WLMH      2DEC   .0008686666   = WL-H = 0.3 DEG/SEC          $450
0175    21,3421  35415 1
0176    21,3422  00018 0  WL        2DEC   .0008888888   = WL   = 0.4 DEG/SEC          $450.
0178    21,3423  22021 1
```

```
0177                          21,3424   12173 1  SLOPE2   DEC    .32          = 0.8 DEG/SEC/DEG                $450/180
0178  REF   5  LAST  688      21,3425   3 1655 0 JETS     CA     ADB
0179  REF  13  LAST  987      21,3426   6 4710 0          AD     FOUR         AF = FLAT REGION = .044 DEG
0180  REF  21  LAST  998      21,3427   55=502 0          TS     TSTEMP       ADB+AF
0181  REF  43  LAST  989      21,3430   3 4711 1          CAF    TWO
0182  REF  28  LAST  990      21,3431   55=508 1 JLOOP    TS     SPNDX
0183                          21,3432   6 0000 1          DOUBLE
0184  REF  24  LAST  990      21,3433   55=507 0          TS     DPNDX
0185                          21,3434   0 0006 1          EXTEND
0186  REF 229  LAST  996      21,3435   5 0000 1          INDEX  A
0187  REF   9  LAST  977      21,3436   3 1534 1          DCA    ADOT
0188  REF   2  LAST  106      21,3437   53=516 0          DXCH   EDOT
0189  REF  17  LAST  999      21,3440   3 1332 1          CA     HOLDFLAG     HOLDFLAG = +0 MEANS THAT DAP IS IN
0190                          21,3441   0 0006 1          EXTEND              ATTITUDE HOLD AND RATE DAMPING IS OVER.
0191  REF   1                 21,3442   1 3447 1          BZF    INHOLD       IF THIS IS THE CASE, BYPASS ADDITION
A01911                                                                        OF WBODY AND GO TO INHOLD
0192                          21,3443   0 0006 1          EXTEND
0193  REF  25  LAST 1001      21,3444   5 1507 1          INDEX  DPNDX
0194  REF  15  LAST  999      21,3445   4 1526 0          DCS    WBODY
0195  REF   3  LAST 1001      21,3446   21=516 0          DAS    EDOT         = ADOT-WBODY
0196  REF  29  LAST 1001      21,3447   51=506 0 INHOLD   INDEX  SPNDX
0197  REF  13  LAST  999      21,3450   3 1567 1          CA     ERRORX
0198  REF   2  LAST  106      21,3451   55=517 1          TS     AERR         AERR = BIAS + AK

0199  REF   4  LAST 1001      21,3452   11=515 0          CCS    EDOT
0200  REF   1                 21,3453   1 3463 1          TCF    POSVEL
0201  REF   1                 21,3454   1 3456 1          TCF    SIGNCK1
0202  REF   1                 21,3455   1 3473 0          TCF    NEGVEL
0203  REF   5  LAST 1001      21,3456   11=516 0 SIGNCK1  CCS    EDOT +1
0204  REF   2  LAST 1001      21,3457   1 3463 1          TCF    POSVEL
0205  REF   3  LAST 1001      21,3460   1 3463 1          TCF    POSVEL
0206  REF   2  LAST 1001      21,3461   1 3473 0          TCF    NEGVEL
0207  REF   3  LAST 1001      21,3462   1 3473 0          TCF    NEGVEL
0208                          21,3463   0 0006 1 POSVEL   EXTEND
0209  REF   6  LAST 1001      21,3464   3 1518 1          DCA    EDOT
0210  REF   2  LAST  106      21,3465   53=521 1          DXCH   EDOTVEL
0211  REF  22  LAST 1001      21,3466   3 1502 1          CA     TSTEMP
0212  REF   1                 21,3467   55=523 0          TS     ADBVEL       +(ADB+AF)
0213  REF   3  LAST 1001      21,3470   3 1517 0          CA     AERR
0214  REF   2  LAST  106      21,3471   55=522 1          TS     AERRVEL
0215  REF   1                 21,3472   0 3502 0          TC     J6.
0216                          21,3473   0 0006 1 NEGVEL   EXTEND
0217  REF   7  LAST 1001      21,3474   4 1516 0          DCS    EDOT
0218  REF   3  LAST 1001      21,3475   53=521 1          DXCH   EDOTVEL
0219  REF  23  LAST 1001      21,3476   4 1502 0          CS     TSTEMP
0220  REF   2  LAST 1001      21,3477   55=523 0          TS     ADBVEL       -(ADB+AF)
0221  REF   4  LAST 1001      21,3500   4 1517 1          CS     AERR
0222  REF   3  LAST 1001      21,3501   55=522 1          TS     AERRVEL

0223                          21,3502   0 0006 1 J6.      EXTEND
```

```
0224  REF   6  LAST 1001   21,3503  61*655 0          SU     ADB
0225  REF   1              21,3504  6 3414 0          AD     WLH/SLOP
0226                       21,3505  0 0006 1          EXTEND
0227  REF   1              21,3506  6 3535 1          BZMF   J8

0228  REF  24  LAST 1001   21,3507  4 1502 0          CS     T5TEMP        (ADB+AP)
0229  REF   4  LAST 1001   21,3510  6 1522 0          AD     AERRVEL
0230                       21,3511  0 0006 1          EXTEND
0231                       21,3512  6 3514 1          BZMF   +2
0232  REF   1              21,3513  1 3526 1          TCF    J7
0233                       21,3514  0 0006 1          EXTEND
0234  REF   4  LAST 1001   21,3515  4 1521 1          DCS    EDOTVEL
0235                       21,3516  0 0006 1          EXTEND
0236  REF   3  LAST  985   21,3517  11*654 0          DV     SLOPE
0237                       21,3520  0 0006 1          EXTEND
0238  REF   5  LAST 1002   21,3521  61*522 0          SU     AERRVEL
0239  REF   7  LAST 1002   21,3522  6 1655 0          AD     ADB
0240                       21,3523  0 0006 1          EXTEND
0241  REF   1              21,3524  6 3614 1          BZMF   J16
0242  REF   1              21,3525  1 3670 1          TCF    J23

0243  REF   1              21,3526  4 3415 0  J7      CS     WL-H/SLP
0244                       21,3527  0 0006 1          EXTEND
0245  REF  25  LAST 1002   21,3530  61*502 1          SU     T5TEMP        (ADB+AP)
0246  REF   6  LAST 1002   21,3531  6 1522 0          AD     AERRVEL
0247                       21,3532  0 0006 1          EXTEND
0248  REF   1              21,3533  6 3620 0          BZMF   J20
0249  REF   1              21,3534  1 3631 1          TCF    J21

0250                       21,3535  0 0006 1  J8      EXTEND
0251  REF   1              21,3536  4 3417 1          DCS    WLH
0252  REF   6  LAST  994   21,3537  53*514 1          DXCH   WTEMP
0253                       21,3540  0 0006 1          EXTEND
0254  REF   5  LAST 1002   21,3541  3 1521 0          DCA    EDOTVEL
0255  REF   7  LAST 1002   21,3542  21*514 1          DAS    WTEMP
0256  REF   8  LAST 1002   21,3543  11*513 0          CCS    WTEMP
0257  REF   1              21,3544  1 3657 1          TCF    J22
0258  REF   1              21,3545  1 3547 0          TCF    SIGNCK2
0259  REF   1              21,3546  1 3553 0          TCF    NJ22
0260  REF   9  LAST 1002   21,3547  11*514 1  SIGNCK2  CCS    WTEMP +1
0261  REF   2  LAST 1002   21,3550  1 3657 1          TCF    J22
0262  REF   3  LAST 1002   21,3551  1 3657 1          TCF    J22
0263  REF   2  LAST 1002   21,3552  1 3553 0          TCF    NJ22

0264                       21,3553  0 0006 1  NJ22    EXTEND
0265  REF   6  LAST 1002   21,3554  3 1521 0          DCA    EDOTVEL
0266                       21,3555  0 0006 1          EXTEND
0267  REF   4  LAST 1002   21,3556  11*654 0          DV     SLOPE
0268  REF  28  LAST 1002   21,3557  6 1502 1          AD     T5TEMP        (ADB+AP)
0269  REF   7  LAST 1002   21,3560  6 1522 0          AD     AERRVEL
```

```
0270   REP 230  LAST 1001   21,3561  10 000 0          CCS   A
0271   REP   2  LAST 1002   21,3562  1 3670 1          TCF   J23
0272   REP   3  LAST 1003   21,3563  1 3670 1          TCF   J23
0273                        21,3564  1 3566 0          TCF   +2
0274   REP   4  LAST 1003   21,3565  1 3670 1          TCF   J23

0275                        21,3566  0 0006 1          EXTEND
0276   REP   1               21,3567  4 3421 1          DCS   WLMH          WL - H
0277   REP  10  LAST 1002   21,3570  53=514 1          DXCH  WTEMP
0278                        21,3571  0 0006 1          EXTEND
0279   REP   7  LAST 1002   21,3572  3 1521 0          DCA   EDOTVEL
0280   REP  11  LAST 1003   21,3573  21=514 1          DAS   WTEMP
0281   REP  12  LAST 1003   21,3574  11=513 0          CCS   WTEMP
0282   REP   5  LAST 1003   21,3575  1 3670 1          TCF   J23
0283   REP   1               21,3576  1 3600 0          TCF   SIGNCK3
0284   REP   1               21,3577  1 3604 1          TCF   NJ23
0285   REP  13  LAST 1003   21,3600  11=514 1  SIGNCK3  CCS   WTEMP +1
0286   REP   6  LAST 1003   21,3601  1 3670 1          TCF   J23
0287   REP   7  LAST 1003   21,3602  1 3670 1          TCF   J23
0288   REP   2  LAST 1003   21,3603  1 3604 1          TCF   NJ23

0289   REP   8  LAST 1002   21,3604  3 1522 0  NJ23    CA    AERRVEL
0290   REP  27  LAST 1002   21,3605  6 1502 1          AD    T5TEMP        (ADB+AP)
0291   REP   2  LAST 1002   21,3606  6 3415 1          AD    WL-H/SLP
0292   REP 231  LAST 1003   21,3607  10 000 0          CCS   A
0293   REP   1               21,3610  1 3702 0          TCF   J24
0294   REP   2  LAST 1003   21,3611  1 3702 0          TCF   J24
0295   REP   4  LAST 1002   21,3612  1 3657 1          TCF   J22
0296   REP   5  LAST 1003   21,3613  1 3657 1          TCF   J22

0297                        21,3614  0 0006 1  J16     EXTEND
0298   REP   8  LAST 1001   21,3615  4 1516 0          DCS   EDOT
0299   REP  24  LAST  996   21,3616  53=511 1          DXCH  KMPAC
0300   REP   1               21,3617  1 3713 0          TCF   JTIME

0301   REP   5  LAST 1001   21,3620  4 1517 1  J20     CS    AERR
0302   REP   3  LAST 1001   21,3621  6 1523 1          AD    ADBVEL
0303                        21,3622  0 0006 1          EXTEND
0304   REP   1               21,3623  7 3424 1          MP    SLOPE2        (HYSTERESIS SLOPE)
0305   REP  25  LAST 1003   21,3624  53=511 1          DXCH  KMPAC
0306                        21,3625  0 0006 1          EXTEND
0307   REP   9  LAST 1003   21,3626  4 1516 0          DCS   EDOT
0308   REP  26  LAST 1003   21,3627  21=511 1          DAS   KMPAC
0309   REP   2  LAST 1003   21,3630  1 3713 0          TCF   JTIME

0310   REP  10  LAST 1003   21,3631  11=515 0  J21     CCS   EDOT
0311   REP   1               21,3632  1 3650 0          TCF   JP
0312   REP   1               21,3633  1 3635 0          TCF   SIGNCK4
0313   REP   1               21,3634  1 3641 0          TCF   JN
0314   REP  11  LAST 1003   21,3635  11=516 0  SIGNCK4  CCS   EDOT +1
```

```
0315   REP   2  LAST 1003   21,3636  1 3650 0          TCF    JP
0316   REP   3  LAST 1004   21,3637  1 3650 0          TCF    JP
0317   REP   2  LAST 1003   21,3640  1 3641 0          TCF    JN
0318                        21,3641  0 0006 1  JN      EXTEND
0319   REP  12  LAST 1003   21,3642  4 1516 0          DCS    EDOT
0320   REP  27  LAST 1003   21,3643  53"511 1          DXCH   KMPAC
0321                        21,3644  0 0006 1          EXTEND
0322   REP   1              21,3645  3 3423 1          DCA    WL
0323   REP  28  LAST 1004   21,3646  21"511 1          DAS    KMPAC
0324   REP   3  LAST 1003   21,3647  1 3713 0          TCF    JTIME

0325                        21,3650  0 0006 1  JP      EXTEND
0326   REP  13  LAST 1004   21,3651  4 1516 0          DCS    EDOT
0327   REP  29  LAST 1004   21,3652  53"511 1          DXCH   KMPAC
0328                        21,3653  0 0006 1          EXTEND
0329   REP   2  LAST 1004   21,3654  4 3423 0          DCS    WL
0330   REP  30  LAST 1004   21,3655  21"511 1          DAS    KMPAC
0331   REP   4  LAST 1004   21,3656  1 3713 0          TCF    JTIME

0332   REP  14  LAST 1004   21,3657  11"515 0  J22     CCS    EDOT
0333   REP   3  LAST 1004   21,3660  1 3641 0          TCF    JN
0334   REP   1              21,3661  1 3663 0          TCF    SIGNCK5
0335   REP   4  LAST 1004   21,3662  1 3650 0          TCF    JP
0336   REP  15  LAST 1004   21,3663  11"516 0  SIGNCK5 CCS    EDOT +1
0337   REP   4  LAST 1004   21,3664  1 3641 0          TCF    JN
0338   REP   5  LAST 1004   21,3665  1 3641 0          TCF    JN
0339   REP   5  LAST 1004   21,3666  1 3650 0          TCF    JP
0340   REP   6  LAST 1004   21,3667  1 3650 0          TCF    JP

0341   REP  30  LAST 1001   21,3670  51"506 0  J23     INDEX  SPNDX
034151 REP  40  LAST  996   21,3671  4 4676 0          CS     BIT13     RESET RATE DAMPING FLAG
034152 REP  44  LAST  999   21,3672  7 1501 0          MASK   RCSFLAGS  BIT13 FOR ROLL  (SPNDX = 0)
034153 REP  45  LAST 1004   21,3673  55"501 0          TS     RCSFLAGS  BIT12 FOR PITCH (SPNDX = 1)
A034154                                                               BIT11 FOR YAW   (SPNDX = 2)

034155 REP  31  LAST 1004   21,3674  51"506 0          INDEX  SPNDX
034156 REP   1              21,3675  3 3017 1          CAF    OCT01400  IS THERE TO BE A FORCED FIRING ON THIS
034157 REP  46  LAST 1004   21,3676  7 1501 0          MASK   RCSFLAGS  AXIS
034158                      21,3677  0 0006 1          EXTEND
034159 REP   1              21,3700  1 3734 0          BZF    DOJET +2  NO, GO TO DOJET +2 AND DO NOTHING

03416  REP   2  LAST 1002   21,3701  1 3614 0          TCF    J18       YES, GO TO J18 AND FORCE A FIRING

0342   REP   6  LAST 1003   21,3702  4 1517 1  J24     CS     AERR
0343                        21,3703  0 0006 1          EXTEND
0344   REP   4  LAST 1003   21,3704  61"523 1          SU     ADSVEL
0345                        21,3705  0 0006 1          EXTEND
0346   REP   2  LAST 1003   21,3706  7 3424 1          MP     SLOPE2    (HYSTERESIS SLOPE)
0347   REP  31  LAST 1004   21,3707  53"511 1          DXCH   KMPAC
0348                        21,3710  0 0006 1          EXTEND
```

```
0349   REF  16  LAST 1004   21,3711  4 1516 0          DCS    EDOT
0350   REF  32  LAST 1004   21,3712  21=511 1          DAS    KMPAC
```

```
P0351        COMPUTE THE JET ON TIME NECESSARY TO ACCOMPLISH THE DESIRED CHANGE IN RATE, IE

R0353              T  = J/M(DELTA W)
R0354               J

R0355        DELTA W = DESIRED CHANGE IN S/C ANGULAR RATE AS DETERMINED BY THE
R0356                  SWITCHING LOGIC,  AT THIS POINT STORED IN KMPAC.

R0357           J/M  = S/C INERTIA TO TORQUE RATIO  SCALED BY
R0358                  (57.3/450)(B24/1600)(1/.6)
R0359                  FOR 1 JET OPERATION  (M = 700 FT-LB).
R0360                  IE  J/M = J(SLUG-FTFT) X 0.00000085601606

R0361                  THE CORRESPONDING COMPUTER VARIABLES ESTABLISHED BY
R0362                  KEYBOARD ENTRY ARE
R0363                     J/M (ROLL)
R0364                     J/M1 (PITCH)
R0365                     J/M2 (YAW)

R0366            T  = JET ON-TIME      SCALED 16384/1600 SEC
R0367             J

R0368                  THE COMPUTER VARIABLES ARE
R0369                     TAU  (ROLL)
R0370                     TAU1 (PITCH)
R0371                     TAU2 (YAW)
 0372   REF  32  LAST 1004   21,3713  51=506 0  JTIME   INDEX  SPNDX     PICK UP S/C INERTIA/TORQUE RATIO
 0373   REF   3  LAST  691   21,3714  3 1623 1          CA     J/M       SCALED (57.3/450)(B24/1600)
 0374   REF   2  LAST  976   21,3715  0 2026 1          TC     SMALLMP   FOR 1-JET OPERATION
 0375   REF  29  LAST  955   21,3716  3 4700 1          CA     BIT11
 0376   REF   3  LAST 1006   21,3717  0 2026 1          TC     SMALLMP
 0377   REF  33  LAST 1005   21,3720  11=510 0          CCS    KMPAC
 0378                        21,3721  1 3725 0          TCP    +4
 0379   REF   1              21,3722  1 3731 0          TCP    TAUNORM
 0380                        21,3723  1 3727 1          TCP    +4
 0381   REF   2  LAST 1006   21,3724  1 3731 0          TCP    TAUNORM
 0382   REF  26  LAST  973   21,3725  3 4672 0          CA     POSMAX
 0383   REF   2  LAST 1004   21,3726  1 3732 0          TCP    DOJET
 0384   REF   6  LAST  971   21,3727  3 4674 0          CA     NEGMAX
 0385   REF   3  LAST 1006   21,3730  1 3732 0          TCP    DOJET

 0386   REF  34  LAST 1006   21,3731  3 1511 0  TAUNORM CA     KMPAC +1
 0387   REF  33  LAST 1006   21,3732  51=506 0  DOJET   INDEX  SPNDX
 0388   REF   4  LAST  996   21,3733  55=561 0          TS     TAU
 0389   REF  34  LAST 1006   21,3734  11=506 1          CCS    SPNDX
 0390   REF   1              21,3735  1 3431 0          TCP    JLOOP
 0391   REF   2  LAST  991   21,3736  1 3743 0          TCP    T6PROG
```

```
0392  REP 184  LAST  999   21,3737  3 4714 1  ZEROCMDS CAF    ZERO
0393  REP   5  LAST 1006   21,3740  55=561 0           TS     TAU
0394  REP   4  LAST  996   21,3741  55=562 0           TS     TAU1
0395  REP   4  LAST  997   21,3742  55=563 1           TS     TAU2
0396                       21,3743  0 0006 1  TSPROG   EXTEND
0397  REP   1              21,3744  3 3750 0           DCA    JETADDR
0398  REP  20  LAST  973   21,3745  53=313 0           DXCH   TSLOC
0399  REP  39  LAST  994   21,3746  1 5222 1           TCF    RESUME

0400  REP  35  LAST 1006   E6,1510                    EBANK= KMPAC
0401  REP   1              21,3747    02577 0 JETADDR 2CADR  JETSLECT
0401  REP   1              21,3750    38066 1
```

WHEN THE ROTATION COMMANDS (TAUS)
HAVE BEEN DETERMINED
RESET TSLOC FOR PHASE3

L RCS-CSM DAP EXECUTIVE PROGRAMS USER'S PAGE NO. 1 E0 S3

R0001 CALCULATION OF AMGB, AMBG ONCE EVERY SECOND

R0002 AMGB = 1 SIN(PSI) 0
R0003 0 COS(PSI)COS(PHI) SIN(PHI)
R0004 0 -COS(PSI)SIN(PHI) COS(PHI)
R0005
R0006 AMBG = 1 -TAN(PSI)COS(PHI) TAN(PSI)SIN(PHI)
R0007 0 COS(PHI)/COS(PSI) -SIN(PHI)/COS(PSI)
R0008 0 SIN(PHI) COS(PHI)
R0009
R0010 WHERE PHI AND PSI ARE CDU ANGLES
R0011
R0012

```
0013                        20,3565                 BANK   20
0014  REF  1                22,2000                 SETLOC DAPS8
0015                        22,3444                 BANK

0016  REF  1                                        COUNT* $$/DAPEX
0017  REF  36  LAST 1007    E6,1510                 EBANK= KMPAC
0018  REF  26  LAST  904    22,3444  3 0102 1 AMBGUPDT CA    FLAGWRD6      CHECK FOR RCS AUTOPILOT
0019                        22,3445  0 0006 1        EXTEND
0020  REF 105  LAST  945    22,3446  6 5112 0        BZMF   ENDOFJOB      BIT15 = 0, BIT14 = 1
0021  REF  61  LAST  996    22,3447  7 4675 0        MASK   BIT14         IF NOT RCS, EXIT
0022                        22,3450  0 0006 1        EXTEND
0023  REF 106  LAST 1006    22,3451  1 5112 1        BZF    ENDOFJOB      TO PROTECT TVC DAP ON SWITCHOVER

0024  REF  19  LAST  999    22,3452  3 0034 0        CA     CDUZ
0025  REF  1                22,3453  0 4770 0        TC     SPSIN2
0026  REF  5   LAST  998    22,3454  55<640 0        TS     AMGB1         CALCULATE AMGB
0027  REF  20  LAST 1008    22,3455  3 0034 0        CA     CDUZ
0028  REF  1                22,3456  0 4767 0        TC     SPCOS2
0029  REF  2   LAST  108    22,3457  55<645 0        TS     CAPSI         MUST CHECK FOR GIMBAL LOCK
0030  REF  1                22,3460  3 3504 0        CAF    QUADANGL      = 7.25  DEGREES JET QUAD ANGULAR OFFSET
0031                        22,3461  0 0006 1        EXTEND
0032  REF  25  LAST  999    22,3462  20 032 1        MSU    CDUX
0033                        22,3463  4 0000 0        COM                  CDUX - 7.25 DEG
0034  REF  1                22,3464  0 4767 0        TC     SPCOS1
0035  REF  5   LAST  998    22,3465  55<644 1        TS     AMGB6
0036                        22,3468  0 0008 1        EXTEND
0037  REF  3   LAST 1006    22,3467  7 1645 0        MP     CAPSI
0038  REF  5   LAST  996    22,3470  55<641 1        TS     AMGB4
0039  REF  2   LAST 1008    22,3471  3 3504 0        CAF    QUADANGL
0040                        22,3472  0 0006 1        EXTEND
0041  REF  26  LAST 1006    22,3473  20 032 1        MSU    CDUX
0042                        22,3474  4 0000 0        COM                  CDUX - 7.25 DEG
0043  REF  1                22,3475  0 4770 0        TC     SPSIN1
0044  REF  5   LAST  996    22,3476  55<642 1        TS     AMGB5
0045                        22,3477  0 0006 1        EXTEND
0046  REF  4   LAST 1006    22,3500  7 1645 0        MP     CAPSI
0047                        22,3501  4 0000 0        COM
```

```
0048   REF   5  LAST  998    22,3502  55=643 0          TS     AMGB7
0049   REF 107  LAST 1008    22,3503  1 5112 1          TCF    ENDOFJOB
0050                         22,3504   01224 1 QUADANGL DEC    660          = 7.25 DEGREES
```

```
0001                                21,3751                 BANK    21
0002    REF   2  LAST  963         17,2000                 SETLOC  DAPS4
0003                                17,2577                 BANK

0004    REF   1                                             COUNT   17/DAPJS

0005    REF  37  LAST 1006   E6,1510                        EBANK=  KMPAC
R0006   EXAMINE CHANNEL 31 FOR TRANSLATION COMMANDS

0007    REF  16  LAST  973   17,2577  22 016 0  JETSLECT LXCH    BANKRUPT
0008    REF   1              17,2600  3 2661 1            CAF     DELTATT3    = 60 MS   RESET TO EXECUTE PHASE1
0009    REF   6  LAST  992   17,2601  6 1634 1            AD      T5TIME
0010    REF  23  LAST  993   17,2602  54 030 0            TS      TIME5
0011                         17,2603  1 2606 1            TCF     +3
0012    REF   1              17,2604  3 2662 1            CAF     DELATT20    = 20 MS   TO ASSURE A T5RUPT
0013    REF  24  LAST 1010   17,2605  54 030 0            TS      TIME5
0014    REF   1              17,2606  3 3340 0            CAF     =14MS       RESET T6 TO INITIALIZE THE JET CHANNELS
0015    REF   4  LAST  987   17,2607  54 031 1            TS      TIME6       IN 14 MS
0016    REF   9  LAST 1006   17,2610  3 4674 0            CAF     NEGMAX
0017                         17,2611  0 0006 1            EXTEND
0018    REF  10  LAST  987   17,2612  05 013 0            WOR     CHAN13
0019                         17,2613  0 0006 1            EXTEND
0020    REF  14  LAST  973   17,2614  22 012 1            QXCH    QRUPT
0021    REF   1              17,2615  3 2660 0            CAF     XLNMASK     = 7700 OCT
0022                         17,2616  0 0006 1            EXTEND                EXAMINE THE TRANSLATION
0023    REF  12  LAST  996   17,2617  06 031 0            RXOR    CHAN31        HAND CONTROLLER
0024    REF   2  LAST 1010   17,2620  7 2660 1            MASK    XLNMASK
0025                         17,2621  0 0006 1            EXTEND
0026    REF   1              17,2622  1 2663 1            BZF     NOXLNCMD
0027    REF  28  LAST 1003   17,2623  55=502 0            TS      T5TEMP
0028                         17,2624  0 0006 1            EXTEND
0029    REF  31  LAST  993   17,2625  7 4702 1            MP      BIT9
0030    REF  30  LAST  992   17,2626  7 6214 1            MASK    THREE
0031    REF   3  LAST  106   17,2627  55=513 0            TS      XNDX1       AC QUAD  X-TRANSLATION INDEX
0032    REF   2  LAST  106   17,2630  55=514 1            TS      XNDX2       BD QUAD  X-TRANSLATION INDEX
0033    REF  29  LAST 1010   17,2631  3 1502 1            CA      T5TEMP
0034                         17,2632  0 0006 1            EXTEND                1 = + XLN
0035    REF  44  LAST  990   17,2633  7 4704 1            MP      BIT7          2 = - XLN
0036    REF  31  LAST 1010   17,2634  7 6214 1            MASK    THREE         3 = NO XLN
0037    REF   3  LAST  106   17,2635  55=515 0            TS      YNDX        Y-TRANSLATION INDEX

0038    REF  30  LAST 1010   17,2636  3 1502 1            CA      T5TEMP
0039                         17,2637  0 0006 1            EXTEND
0040    REF  36  LAST  968   17,2640  7 4706 0            MP      BIT5
0041    REF  32  LAST 1010   17,2641  7 6214 1            MASK    THREE
0042    REF   2  LAST  106   17,2642  55=516 0            TS      ZNDX        Z-TRANSLATION INDEX

0043    REF  70  LAST  932   17,2643  3 1466 1            CA      DAPDATR1    SET ATTKALMN TO PICK UP FILTER GAINS FOR
00432   REF  62  LAST 1006   17,2644  7 4675 0            MASK    BIT14       TRANSLATIONS.
00434                        17,2645  0 0006 1            EXTEND              CHECK DAPDATR1 BIT 14 FOR LEM ATTACHED.
```

L JET SELECTION LOGIC USER=S PAGE NO. 2 E6 S3

```
00436 REF   1                17,2646  1 2651 0          BZF   NOLEM
00438 REF  33  LAST 1010     17,2647  4 6214 1          CS    THREE      IF LEM IS ON, SET ATTKALMN = -3
0044                         17,2650  1 2652 0          TCP   +2
00442 REF  44  LAST 1001     17,2651  4 4711 0 NOLEM    CS    TWO        IF LEM IS OFF, SET ATTKALMN = -2.
00444 REF  10  LAST  992     17,2652  55=617 1          TS    ATTKALMN
0045  REF   4  LAST  688     17,2653  11=631 0          CCS   XTRANS     (+, -1, 0)
0046  REF   4  LAST 1010     17,2654  55=513 0          TS    XNDX1      USING BD-X  ZERO XNDX1
0047  REF   1                17,2655  1 2667 0          TCP   PWORD
0048  REF   3  LAST 1010     17,2656  55=514 1          TS    XNDX2      USING AC-X  ZERO XNDX2
0049  REF   2  LAST 1011     17,2657  1 2667 0          TCP   PWORD
0050                         17,2660   07700 1 XLNMASK  OCT   7700
0051                         17,2661   37772 1 DELTATT3 DEC   16378      = 60 MS
0052                         17,2662   37776 0 DELATT20 DEC   16382      = 20 MS

0053  REF   5  LAST 1011     17,2663  55=513 0 NOXLNCMD TS    XNDX1      ZERO ALL REQUESTS FOR TRANSLATION
0054  REF   4  LAST 1011     17,2664  55=514 1          TS    XNDX2
0055  REF   4  LAST 1010     17,2665  55=515 0          TS    YNDX
0056  REF   3  LAST 1010     17,2666  55=516 0          TS    ZNDX

R0057 PITCH COMMANDS  TIMING(NO X-TRANS, NO QUAD FAILS) 32MCT

0058  REF   5  LAST 1007     17,2667  11=562 0 PWORD    CCS   TAU1       CHECK FOR PITCH COMMANDS
0059  REF 107  LAST  996     17,2670  3 4712 1          CAF   ONE
0060                         17,2671  1 2673 0          TCP   +2          0 = NO PITCH
0061  REF  45  LAST 1011     17,2672  3 4711 1          CAF   TWO         +1 =  + PITCH
0062  REF   2  LAST  106     17,2673  55=520 0          TS    PINDEX      +2 =  - PITCH

0063  REF   5  LAST  689     17,2674  11=626 0          CCS   RACFAIL     FLAG FOR REAL AC QUAD FAILURES
0064  REF   1                17,2675  1 2701 1          TCP   APAILP
0065  REF   1                17,2676  1 2711 0          TCP   TABPCOM     0 = NO REAL AC FAILURES
0066  REF   1                17,2677  1 2703 0          TCP   CPAILP      + = A QUAD FAILED
0067  REF   2  LAST 1011     17,2700  1 2711 0          TCP   TABPCOM     - = C QUAD FAILED
A0068                                                                    IF FAILURES ARE PRESENT IGNORE
A0069                                                                    X-TRANSLATIONS ON THIS AXIS

0070  REF   5  LAST  977     17,2701  3 4334 1 APAILP   CAF   NINE       IF FAILURE IS PRESENT 1JET OPERATION
0071  REF   3  LAST 1011     17,2702  1 2713 1          TCP   TABPCOM +2 IS ASSUMED. IGNORE X-TRANSLATION
0072  REF   2  LAST  824     17,2703  3 5656 1 CPAILP   CAF   TWELVE
0073  REF   4  LAST 1011     17,2704  1 2713 1          TCP   TABPCOM +2

0074                         17,2705   00000 1 XLNNDX   DEC   0          INDECES FOR TRANSLATION COMMANDS
0075                         17,2706   00003 1          DEC   3          FOR USE IN TABLE LOOK UP
0076                         17,2707   00006 1          DEC   6
0077                         17,2710   00000 1          DEC   0

0078  REF   3  LAST  712      5656              TWELVE  =     OCT14
R0079 TABLE LOOK UP FOR PITCH COMMANDS WITH AND WITHOUT X-TRANSLATION AND AC QUAD FAILURES PRESENT.
R0081 BITS 9, 10 CONTAIN THE NUMBER OF PITCH JETS USED TO PERFORM THE PITCH ROTATION
```

L JET SELECTION LOGIC


```
0083  REF   6  LAST 1011   17,2711  51=513 1  TABPCOM  INDEX  XNDX1
0084  REF   1              17,2712  3 2705 1           CA     XLNNDX
0085  REF   3  LAST 1011   17,2713  6 1520 1           AD     PINDEX
0086  REF 232  LAST 1003   17,2714  50 000 1           INDEX  A
0087  REF   1              17,2715  3 2741 1           CA     PYTABLE
0088  REF   1              17,2716  7 2760 0           MASK   PJETS      =1417 OCT
0089  REF   2  LAST  100   17,2717  55=453 0           TS     PWORD1
0090                       17,2720  0 0006 1           EXTEND
0091  REF  45  LAST 1010   17,2721  7 4704 1           MP     BIT7
0092  REF   2  LAST  106   17,2722  55=523 0           TS     NPJETS     = NO. OF PITCH JETS

R0093  YAW JET COMMANDS  TIMING(NO X-TRANS, NO QUAD FAILURES)  32MCT

0094  REF   5  LAST 1007   17,2723  11=563 1  YWORD    CCS    TAU2       CHECK FOR YAW COMMANDS
0095  REF 108  LAST 1011   17,2724  3 4712 1           CAF    ONE
0096                       17,2725  1 2727 0           TCF    +2
0097  REF  46  LAST 1011   17,2726  3 4711 1           CAF    TWO
0098  REF   2  LAST  106   17,2727  55=521 1           TS     YINDEX     YAW ROTATION INDEX

0099  REF   5  LAST  689   17,2730  11=627 1           CCS    RBDFAIL    FLAG FOR B OR D QUAD FAILURES
0100  REF   1              17,2731  1 2735 0           TCF    BFAILY     0 = NO BD FAILURE
0101  REF   1              17,2732  1 2762 1           TCF    TABYCOM    + = B QUAD FAILED
0102  REF   1              17,2733  1 2737 1           TCF    DFAILY     - = D QUAD FAILED
0103  REF   2  LAST 1012   17,2734  1 2762 1           TCF    TABYCOM

0104  REF   6  LAST 1011   17,2735  3 4334 1  BFAILY   CAF    NINE
0105  REF   3  LAST 1012   17,2736  1 2764 1           TCF    TABYCOM +2
0106  REF   3  LAST 1011   17,2737  3 5656 1  DFAILY   CAF    TWELVE
0107  REF   4  LAST 1012   17,2740  1 2764 1           TCF    TABYCOM +2
```

```
P0108   TABLE FOR PITCH(YAW) COMMANDS
R0109   BITS 4,3,2,1 = PITCH, X-TRANSLATION JETS SELECTED
R0110   BITS     10,9 = NO. PITCH JETS USED TO PERFORM ROTATION
R0111   BITS 8,7,6,5 = YAW, X-TRANSLATION JETS SELECTED
R0112   BITS 12,11 ' NO. YAW JETS USED TO PERFORM ROTATION

                                                                    ROT  TRANS  QUAD  BIAS
A0113
 0114                    17,2741   00000 1  PYTABLE  OCT   0         0     0           0
 0115                    17,2742   05125 1           OCT   5125      +     0           0
 0116                    17,2743   05252 1           OCT   5252      -     0           0
 0117                    17,2744   00231 1           OCT   0231      0     +           3
 0118                    17,2745   02421 1           OCT   2421      +     +           3
 0119                    17,2746   02610 1           OCT   2610      -     +           3
 0120                    17,2747   00146 1           OCT   0146      0     -           6
 0121                    17,2750   02504 1           OCT   2504      +     -           6
 0122                    17,2751   02442 1           OCT   2442      -     -           6
 0123                    17,2752   00000 1           OCT   0         0           A(B)  9
 0124                    17,2753   02421 1           OCT   2421      +           A(B)  9
 0125                    17,2754   02442 1           OCT   2442      -           A(B)  9
 0126                    17,2755   00000 1           OCT   0         0           C(D)  12
 0127                    17,2756   02504 1           OCT   2504      +           C(D)  12
 0128                    17,2757   02610 1           OCT   2610      -           C(D)  12

R0129   MASKS FOR PITCH AND YAW COMMANDS

 0130                    17,2760   01417 1  PJETS    OCT   1417
 0131                    17,2761   06360 1  YJETS    OCT   6360

R0132   TABLE LOOK UP FOR YAW COMMANDS WITH AND WITHOUT X-TRANSLATION AND AC QUAD FAILURES PRESENT
R0134   BITS 11, 12 CONTAIN THE NUMBER OF YAW JETS USED TO PERFORM THE YAW ROTATION

 0136   REF   5  LAST 1011   17,2762  51=514 0  TABYCOM  INDEX  XNDX2
 0137   REF   2  LAST 1012   17,2763  3 2705 1           CA     XLNNDX
 0138   REF   3  LAST 1012   17,2764  6 1521 0           AD     YINDEX
 0139   REF 233  LAST 1012   17,2765  50 000 1           INDEX  A
 0140   REF   2  LAST 1012   17,2766  3 2741 1           CA     PYTABLE
 0141   REF   1               17,2767  7 2761 1           MASK   YJETS          = 6360 OCT
 0142   REF   2  LAST  100    17,2770  55=455 0           TS     YWORD1
 0143                         17,2771  0 0006 1           EXTEND
 0144   REF  37  LAST 1010    17,2772  7 4706 0           MP     BIT5
 0145   REF   1               17,2773  55=524 1           TS     NYJETS         NO. OF YAW JETS USED TO PERFORM ROTATION
```

```
P0146   ROLL COMMANDS  TIMING(NO Y,Z TRANS, NO QUAD FAILS)  45MCT

 0147   REP   6  LAST 1007   17,2774  11«561 0  RWORD   CCS    TAU        CHECK FOR ROLL COMMANDS
 0148   REP 109  LAST 1012   17,2775  3 4712 1          CAF    ONE
 0149                       17,2776  1 3000 0          TCF    +2
 0150   REP  47  LAST 1012   17,2777  3 4711 1          CAF    TWO
 0151   REP   2  LAST  106   17,3000  55«517 1          TS     RINDEX

 0152   REP   3  LAST  669   17,3001  11«630 1          CCS    ACORBD     FLAG FOR AC OR BD QUAD SELECTION FOR
 0153   REP   1              17,3002  1 3073 1          TCF    BDROLL     ROLL COMMANDS
 0154   REP   2  LAST 1014   17,3003  1 3073 1          TCF    BDROLL     +, +0 = BD ROLL
 0155                       17,3004  1 3005 0          TCF    +1         -, -0 = AC ROLL

 0156   REP   6  LAST 1011   17,3005  11«626 0  ACROLL  CCS    RACFAIL    CHECK FOR REAL FAILURES
 0157   REP   1              17,3006  1 3012 0          TCF    RAFAIL     ON AC QUADS
 0156   REP   1              17,3007  1 3022 0          TCF    RXLNS
 0159   REP   1              17,3010  1 3014 0          TCF    RCFAIL
 0160   REP   2  LAST 1014   17,3011  1 3022 0          TCF    RXLNS

 0161   REP   7  LAST 1012   17,3012  3 4334 1  RAFAIL  CAF    NINE       QUAD FAILURE WILL GET
 0162   REP   1              17,3013  1 3024 0          TCF    TABRCOM    1-JET OPERATION
 0163   REP   4  LAST 1012   17,3014  3 5656 1  RCFAIL  CAF    TWELVE
 0164   REP   2  LAST 1014   17,3015  1 3024 0          TCF    TABRCOM

 0165                       17,3016   00000 1  XLNINDX DEC    0
 0166                       17,3017   00001 0           DEC    1          INDECES FOR TRANSLATION
 0167                       17,3020   00002 0           DEC    2
 0166                       17,3021   00000 1           DEC    0

R0169   TABLE LOOK UP FOR AC-ROLL COMMANDS WITH AND WITHOUT Y-TRANSLATION AND ACQUAD FAILURES PRESENT
R0171   BITS 9,10,11 CONTAIN THE MAGNITUDE AND DIRECTION OF THE ROLL

 0172   REP   5  LAST 1011   17,3022  51«515 1  RXLNS   INDEX  YNDX       NO AC QUAD FAILURES
 0173   REP   3  LAST 1013   17,3023  3 2705 1          CA     XLNNDX     INCLUDE +,-,0, Y-TRANSLATION
 0174   REP   3  LAST 1014   17,3024  6 1517 0  TABRCOM AD     RINDEX
 0175   REP 234  LAST 1013   17,3025  50 000 1          INDEX  A
 0176   REP   1              17,3026  3 3155 0          CA     RTABLE
 0177   REP   1              17,3027  7 3174 1          MASK   ACRJETS    = 3760 OCT
 0176   REP   3  LAST  987   17,3030  55«451 1          TS     RWORD1

R0179   CHECK FOR Z-TRANSLATIONS ON BD

 0180   REP   4  LAST 1011   17,3031  3 1516 1  BDZCHECK CA    ZNDX
 0161                       17,3032  0 0006 1          EXTEND
 0182   REP   1              17,3033  6 3065 1          BZMF   NOBDZ      NO Z-TRANSLATION
```

```
P0163           TABLE LOOK UP FOR BD Z-TRANSLATION WITH AND WITHOUT REAL BD QUAD FAILURES.  Z-TRANSLATION WILL BE POSS-
R0165   IBLE AS LONG AS ROLL COMMANDS CAN BE SATISFIED WITH THE AC ROLL JETS.  CRITERION.. IF THE RESULTANT NET ROLL
R0187   COMMANDS = 0 (WITH Z-TRANSLATION) AND IF TAU = 0, THEN INCLUDE THE BD Z-TRANSLATION COMMANDS. IF THE RESULTANT
R0189   ROLL COMMAND = 0, AND IF TAU NZ, THEN IGNORE THE BD Z-TRANSLATION

 0190   REF   6  LAST 1012   17,3034  11=627 1          CCS     RBDFAIL
 0191   REF  34  LAST 1011   17,3035  3 6214 0          CAF     THREE
 0192                        17,3036  1 3040 1          TCF     +2
 0193   REF  31  LAST  962   17,3037  3 6211 0          CAF     SIX
 0194   REF   5  LAST 1014   17,3040  51=516 1          INDEX   ZNDX
 0195   REF   1              17,3041  6 3016 0          AD      XLN1NDX
 0196   REF 235  LAST 1014   17,3042  50 000 1          INDEX   A
 0197   REF   1              17,3043  3 3176 1          CA      YZTABLE
 0198   REF   1              17,3044  7 3207 0          MASK    BDZJETS         = 3417 OCT
 0199   REF   4  LAST 1014   17,3045  6 1451 0          AD      RWORD1          ADD TO ROLL COMMANDS
 0200   REF  31  LAST 1010   17,3046  55=502 0          TS      T5TEMP          IF POSSIBLE.  MUST CHECK TAU FIRST

 0201                        17,3047  0 0006 1          EXTEND
 0202   REF  46  LAST 1012   17,3050  7 4704 1          MP      BIT7            DETERMINE THE NET ROLL COMMAND WITH
 0203   REF   1              17,3051  6 6061 0          AD      =-4             Z-TRANSLATION ADDED ON
 0204   REF   2  LAST  106   17,3052  55=522 1          TS      NRJETS          NET NO. OF +,- ROLL JETS ON
 0205                        17,3053  0 0006 1          EXTEND
 0206   REF   1              17,3054  1 3060 0          BZF     TAUCHECK

 0207   REF  32  LAST 1015   17,3055  3 1502 1 ACRBDZ   CA      T5TEMP          Z-TRANSLATION ACCEPTED EVEN THO WE MAY
 0208   REF   5  LAST 1015   17,3056  55=451 1          TS      RWORD1          HAVE INTRODUCED AN UNDESIREABLE ROLL
 0209   REF   1              17,3057  1 3321 0          TCF     ROLLTIME        BRANCH TO JET ON-TIME CALCULATIONS

 0210   REF   7  LAST 1014   17,3060  11=561 0 TAUCHECK CCS     TAU
 0211   REF   2  LAST 1014   17,3061  1 3065 0          TCF     NOBDZ
 0212   REF   1              17,3062  1 3055 0          TCF     ACRBDZ
 0213   REF   3  LAST 1015   17,3063  1 3065 0          TCF     NOBDZ
 0214   REF   2  LAST 1015   17,3064  1 3055 0          TCF     ACRBDZ

 0215   REF   6  LAST 1015   17,3065  3 1451 0 NOBDZ    CA      RWORD1          Z-TRANSLATION NOT ACCEPTED
 0216                        17,3066  0 0006 1          EXTEND
 0217   REF  47  LAST 1015   17,3067  7 4704 1          MP      BIT7
 0216   REF   1              17,3070  6 7715 0          AD      =-2
 0219   REF   3  LAST 1015   17,3071  55=522 1          TS      NRJETS
 0220   REF   2  LAST 1015   17,3072  1 3321 0          TCF     ROLLTIME        BRANCH TO JET ON-TIME CALCULATION
```

P0221 BD QUAD SELECTION FOR ROLL COMMANDS

```
0222  REF   7  LAST 1015   17,3073  11«627 1  BDROLL   CCS   RBDFAIL
0223  REF   1              17,3074  1 3100 1           TCF   RBFAIL
0224  REF   1              17,3075  1 3104 0           TCF   RZXLNS
0225  REF   1              17,3076  1 3102 0           TCF   RDFAIL
0226  REF   2  LAST 1016   17,3077  1 3104 0           TCF   RZXLNS
0227  REF   8  LAST 1014   17,3100  3 4334 1  RBFAIL   CAF   NINE
0228  REF   1              17,3101  1 3106 1           TCF   TABRZCMD
0229  REF   5  LAST 1014   17,3102  3 5656 1  RDFAIL   CAF   TWELVE
0230  REF   2  LAST 1016   17,3103  1 3106 1           TCF   TABRZCMD

0231  REF   6  LAST 1015   17,3104  51«516 1  RZXLNS   INDEX ZNDX     NO BD FAILURES
0232  REF   4  LAST 1014   17,3105  3 2705 1           CA    XLNNDX    +,-,0 Z-TRANSLATION PRESENT
0233  REF   4  LAST 1014   17,3106  6 1517 0  TABRZCMD AD    RINDEX
0234  REF 236  LAST 1015   17,3107  50 000 1           INDEX A
0235  REF   2  LAST 1014   17,3110  3 3155 0           CA    RTABLE
0236  REF   1              17,3111  7 3175 0           MASK  BDRJETS   = 34017 OCT
0237  REF   7  LAST 1015   17,3112  55«451 1          TS    RWORD1

0238  REF   6  LAST 1014   17,3113  3 1515 1  ACYCHECK CA    YNDX      ANY Y-TRANSLATION
0239                       17,3114  0 0006 1           EXTEND
0240  REF   1              17,3115  1 3147 1           BZF   NOACY     NO Y-TRANSLATION
0241  REF   7  LAST 1014   17,3116  11«626 0           CCS   RACFAIL
0242  REF  35  LAST 1015   17,3117  3 6214 0           CAF   THREE
0243                       17,3120  1 3122 1           TCF   +2
0244  REF  32  LAST 1015   17,3121  3 6211 0           CAF   SIX
0245  REF   7  LAST 1016   17,3122  51«515 1          INDEX YNDX
0246  REF   2  LAST 1015   17,3123  6 3016 0           AD    XLN1NDX
0247  REF 237  LAST 1016   17,3124  50 000 1           INDEX A
0248  REF   2  LAST 1015   17,3125  3 3176 1           CA    YZTABLE
0249  REF   1              17,3126  7 3210 0           MASK  ACYJETS   = 34360 OCT
0250  REF   8  LAST 1016   17,3127  6 1451 0           AD    RWORD1
0251  REF  33  LAST 1015   17,3130  55«502 0          TS    T5TEMP
0252                       17,3131  0 0006 1           EXTEND          FOR EXPLANATION SEE CODING ON RTABLE
0253  REF  35  LAST  993   17,3132  7 4707 1           MP    BIT4
0254  REF   2  LAST 1015   17,3133  6 6061 0           AD    =-4
0255  REF   4  LAST 1015   17,3134  55«522 1          TS    NRJETS    NO. OF NET ROLL JETS
0256                       17,3135  0 0006 1           EXTEND
0257  REF   1              17,3136  1 3142 1           BZF   TAUCHCK   IF NRJETS = 0

0258  REF  34  LAST 1016   17,3137  3 1502 1  BDRACZ   CA    T5TEMP    Y-TRANSLATION ACCEPTED
0259  REF   9  LAST 1016   17,3140  55«451 1          TS    RWORD1
0260  REF   3  LAST 1015   17,3141  1 3321 0           TCF   ROLLTIME  BRANCH TO JET ON-TIME CALCULATIONS

0261  REF   8  LAST 1015   17,3142  11«561 0  TAUCHCK  CCS   TAU
0262  REF   2  LAST 1016   17,3143  1 3147 1           TCF   NOACY
0263  REF   1              17,3144  1 3137 0           TCF   BDRACZ
0264  REF   3  LAST 1016   17,3145  1 3147 1           TCF   NOACY
0265  REF   2  LAST 1016   17,3146  1 3137 0           TCF   BDRACZ
```

L JET SELECTION LOGIC

Y-TRANSLATION NOT ACCEPTED

```
0266  REF  10  LAST 1016   17,3147  3 1451 0  NOACY   CA      RWORD1
0267                       17,3150  0 0006 1          EXTEND
0268  REF  36  LAST 1016   17,3151  7 4707 1          MP      BIT4
0269  REF   2  LAST 1015   17,3152  6 7715 0          AD      =-2
0270  REF   5  LAST 1016   17,3153  55=522 1          TS      NRJETS
0271  REF   4  LAST 1016   17,3154  1 3321 0          TCF     ROLLTIME
```

R0272 TABLE FOR ROLL, Y AND Z-TRANSLATION COMMANDS

R0273 EITHER AC OR BD ROLL MAY BE SELECTED. IF AC ROLL IS SELECTED, Y-TRANSLATIONS MAY BE SATISFIED SIMULTANEOUSLY
R0275 PROVIDED THAT THERE ARE NO AC QUAD FAILURES. IF THERE ARE AC FAILURES, Y-TRANSLATION COMMANDS WILL BE IGNORED,
R0277 IN WHICH CASE THE ASTRONAUT SHOULD SWITCH TO BD ROLL.
R0276 IF BDROLL IS SELECTED, Z-TRANSLATIONS MAY BE SATISFIED SIMULTANEOUSLY PROVIDED THAT THERE ARE NO BD QUAD
R0280 FAILURES. IF THERE ARE BD FAILURES, Z-TRANSLATION COMMANDS WILL BE IGNORED, IN WHICH CASE THE ASTRONAUT SHOULD
R0282 SWITCH TO AC ROLL.
R0283 NOTE THAT IF ONE QUAD FAILS (E.G. B FAILED), Z-TRANSLATION IS STILL POSSIBLE AND THAT THE UNDESIREABLE ROLL
R0285 INTRODUCED BY THIS TRANSLATION WILL BE COMPENSATED BY THE TWO AC ROLL JETS ACTUATED BY THE AUTOPILOT LOGIC.

R0287 WORD MAKE UP....RTABLE

R0288 TWO WORDS, CORRESPONDING TO AC OR BD ROLL SELECTION, HAVE BEEN COMBINED INTO ONE TABLE. THE WORD CORRESPOND-
R0290 ING TO AC ROLL HAS THE FOLLOWING INTERPRETATION..
R0291 BITS 9,10,11 ARE CODED TO GIVE THE NET ROLL TORQUE FOR THE WORD SELECTED. THE CODING IS..
R0293 BIT NO. 11 10 9 NO. OF ROLL JETS

R0294 0 0 0 -2
R0295 0 0 1 -1
R0296 0 1 0 0
R0297 0 1 1 +1
R0298 1 0 0 +2
R0299 THIS WORD MAY THEN BE ADDED TO THE WORD SELECTED FROM THE YZ-TRANSLATION TABLE, WHICH HAS THE SAME TYPE OF
R0301 CODING AS ABOVE, AND THE NET ROLL DETERMINED BY SHIFTING THE RESULTANT WORD RIGHT 8 PLACES AND SUBTRACTING FOUR.

R0303 THE WORD CORRESPONDING TO BD ROLL HAS A SIMILIAR INTERPRETATION, EXCEPT THAT BITS 12, 13, 14 ARE CODED
R0305 (AS ABOVE) TO GIVE THE NET ROLL TORQUE.

```
A0306                                                          ROLL    TRANS     QUADFAIL   BIAS

0307          17,3155  11000 1  RTABLE  OCT  11000            0                             0
0308          17,3158  22125 1          OCT  22125            +                             0
0309          17,3157  00252 1          OCT  00252            -                             0
0310          17,3180  11231 1          OCT  11231            0       +Y(+Z)                3
0311          17,3181  15421 1          OCT  15421            +       +Y(+Z)                3
0312          17,3162  04810 1          OCT  04810            -       +Y(+Z)                3
0313          17,3183  11148 1          OCT  11148            0       -Y(-Z)                8
0314          17,3164  15504 1          OCT  15504            +       -Y(-Z)                8
0315          17,3165  04442 1          OCT  04442            -       -Y(-Z)                8
0316          17,3166  11000 1          OCT  11000            0                   A(B)      9
0317          17,3187  15504 1          OCT  15504            +                   A(B)      9
0318          17,3170  04610 1          OCT  04810            -                   A(B)      9
0319          17,3171  11000 1          OCT  11000            0                   C(D)     12
0320          17,3172  15421 1          OCT  15421            +                   C(D)     12
0321          17,3173  04442 1          OCT  04442            -                   C(D)     12
```

```
R0322           RTABLE MASKS -

 0323                    17,3174   03760 0  ACRJETS  OCT   03760
 0324                    17,3175   34017 0  BORJETS  OCT   34017
```

R0325 Y, Z TRANSLATION TABLE

R0326 ONCE AC OR BD ROLL IS SELECTED THE QUAD PAIR WHICH IS NOT BEING USED TO SATISFY THE ROLL COMMANDS MAY BE
R0326 USED TO SATISFY THE REMAINING TRANSLATION COMMANDS. HOWEVER, WE MUST MAKE SURE THAT ROLL COMMANDS ARE SATISFIED
R0330 WHEN THEY OCCUR. THEREFORE, THE Y-Z TRANSLATIONS FROM THIS TABLE WILL BE IGNORED IF THE NET ROLL TORQUE OF THE
R0332 COMBINED WORD IS ZERO AND THE ROLL COMMANDS ARE NON-ZERO. THIS SITUATION WOULD OCCUR, FOR EXAMPLE, IF WE EN-
R0334 COUNTER SIMULTANEOUS +R +Y -Z COMMANDS AND A QUAD D FAILURE WHILE USING AC FOR ROLL.
R0336 TO FACILITATE THE LOGIC, THE Y-Z TRANSLATION TABLE HAS BEEN CODED IN A MANNER SIMILIAR TO THE ROLL TABLE
R0338 ABOVE.
R0339 BITS 9,10,11 ARE CODED TO GIVE THE NET ROLL TORQUE INCURRED BY Z-TRANSLATIONS. THE WORD SELECTED CAN THEN BE
R0341 ADDED TO THE AC-ROLL WORD AND THE RESULTANT ROLL TORQUE DETERMINED FROM THE COMBINED WORD. SIMILIARLY BITS
R0343 12,13,14 ARE CODED TO GIVE THE NET ROLL TORQUE INCURRED BY Y-TRANSLATIONS WHEN BD-ROLL IS SELECTED.

A0345

							TRANSLATION	QUADFAIL	BIAS
0346		17,3176	11000 1	YZTABLE	OCT	11000	0		0
0347		17,3177	11231 1		OCT	11231	+Z(+Y)		0
0346		17,3200	11146 1		OCT	11146	-Z(-Y)		0
0349		17,3201	11000 1		OCT	11000	0	B(A)	3
0350		17,3202	04610 1		OCT	04610	+Z(+Y)	B(A)	3
0351		17,3203	15504 1		OCT	15504	-Z(-Y)	B(A)	3
0352		17,3204	11000 1		OCT	11000	0	D(C)	6
0353		17,3205	15421 1		OCT	15421	+Z(+Y)	D(C)	6
0354		17,3206	04442 1		OCT	04442	-Z(-Y)	D(C)	6

R0355 YZ-TABLE MASKS-

0356	17,3207	03417 0	BDZJETS	OCT	03417	
0357	17,3210	34360 0	ACYJETS	OCT	34360	

R0356 ADDITIONAL CONSTANTS

0359	REF	4	LAST 914	7715	=-2	=	NEG2	
0360	REF	1		6061	=-4	=	NEG4	

P0361 CALCULATION OF JET ON-TIMES

R0362 THE ROTATION COMMANDS (TAU'S), WHICH WERE DETERMINED FROM THE JET SWITCHING LOGIC ON THE BASIS OF SINGLE JET
R0364 OPERATION, MUST NOW BE UPDATED BY THE ACTUAL NUMBER OF JETS TO BE USED IN SATISFYING THESE COMMANDS. TAU MUST
R0366 ALSO BE DECREMENTED ACCORDING TO THE EXPECTED TORQUE GENERATED BY THE NEW COMMANDS ACTING OVER THE NEXT T5 INT-
R0368 ERVAL.
R0369 IN ORDER TO MAINTAIN ACCURATE KNOWLEDGE OF VEHICLE ANGULAR RATES, WE MUST ALSO PROVIDE EXPECTED FIRING TIMES
R0371 (DPT'S, ALSO IN TERMS OF 1-JET OPERATION) FOR THE RATE FILTER.
R0372 NOTE THAT TRANSLATIONS CAN PRODUCE ROTATIONS EVEN THOUGH NO ROTATIONS WERE CALLED FOR. NEVERTHELESS, WE MUST
R0374 UPDATE DPT.
R0375 WHEN THE ROTATIONS HAVE FINISHED, WE MUST PROVIDE CHANNEL INFORMATION TO THE T6 PROGRAM TO CONTINUE ON WITH
R0377 THE TRANSLATIONS. THIS WILL BE DONE IN THE NEXT SECTION. HOWEVER, TO INSURE THAT JETS ARE NOT FIRED FOR LESS
R0379 THAN A MINIMUM IMPULSE (14MS), ALL JET CHANNEL COMMANDS WILL BE HELD FIXED FROM THE START OF THE T5 PROGRAM FOR
R0381 ATLEAST 14MS UNTIL THE INITIALIZATION OF NEW COMMANDS. MOREOVER, A 14MS ON-TIME WILL BE ADDED TO ANY ROTATIONAL
R0383 COMMANDS GENERATED BY THE MANUAL CONTROLS OR THE JET SWITCHING LOGIC, AND ALL TRANSLATION COMMANDS WILL BE
R0385 ACTIVE FOR ATLEAST ONE CYCLE OF THE T5 PROGRAM (.1SEC)

R0386 PITCH JET ON-TIME CALCULATION

```
0387  REF  6  LAST 1011   17,3211  11=562 0  PITCHTIM CCS    TAU1
0388  REF  1              17,3212  1 3221 1            TCF    PTAUPOS
0389                      17,3213  1 3215 0            TCF    +2
0390  REF  1              17,3214  1 3217 1            TCF    PTAUNEG
0391  REF  2  LAST  106   17,3215  55=550 1            TS     DPT1        NO PITCH ROTATION
0392  REF  1              17,3216  1 3417 1            TCF    PBYPASS     COMMANDS

0393  REF  3  LAST 1012   17,3217  4 1523 0  PTAUNEG   CS     NPJETS
0394  REF  4  LAST 1021   17,3220  55=523 0            TS     NPJETS
0395  REF  7  LAST 1021   17,3221  3 1562 1  PTAUPOS   CA     TAU1
0396                      17,3222  0 0006 1            EXTEND
0397  REF  5  LAST 1021   17,3223  5 1523 1            INDEX  NPJETS
0396  REF  1              17,3224  7 3400 1            MP     NJET
0399  REF  3  LAST  987   17,3225  55=461 1            TS     BLAST1
0400  REF  1              17,3226  6 3333 1            AD     =-.1SEC
0401                      17,3227  0 0006 1            EXTEND
0402  REF  1              17,3230  6 3241 0            BZMP   AD14MSP
0403  REF  6  LAST 1021   17,3231  51=523 1            INDEX  NPJETS
0404  REF  1              17,3232  3 3334 0            CA     DPTMAX      THE PITCH ON-TIME IS GREATER THAN .1 SEC
0405  REF  3  LAST 1021   17,3233  55=550 1            TS     DPT1
0406                      17,3234  4 0000 0            COM
0407  REF  8  LAST 1021   17,3235  27=562 0            ADS    TAU1        UPDATE TAU1
0408  REF  1              17,3236  3 3335 1            CAF    =+.1SEC     LIMIT THE LENGTH OF PITCH ROTATION
0409  REF  4  LAST 1021   17,3237  55=461 1            TS     BLAST1      COMMANDS TO 0.1 SEC SO THAT ONLY
0410  REF  1              17,3240  1 3404 0            TCF    ASMBLWP     X-TRANSLATIONS WILL CONTINUE ON SWITCH
A0411                                                                    OVER TO TVC
0412  REF  5  LAST 1021   17,3241  4 1461 1  AD14MSP   CS     BLAST1      SEE IF JET ON TIME LESS THAN
0413  REF  2  LAST 1010   17,3242  6 3340 0            AD     =14MS       MINIMUM IMPULSE TIME
0414                      17,3243  0 0006 1            EXTEND
0415  REF  1              17,3244  6 3247 0            BZMP   PBLASTOK    IF SO LIMIT MINIMUM ON TIME TO 14 MS
0416  REF  3  LAST 1021   17,3245  3 3340 0            CAF    =14MS
```

L JET SELECTION LOGIC


```
0417   REP  6  LAST 1021   17,3246  55=461 1            TS      BLAST1
0416   REP  7  LAST 1022   17,3247  3 1461 0  PBLASTOK  CA      BLAST1
0419                       17,3250  0 0006 1            EXTEND
0420   REP  7  LAST 1021   17,3251  7 1523 0            MP      NPJETS
0421   REP  4  LAST 1021   17,3252  23=550 0            LXCH    DFT1
0422   REP  9  LAST 1021   17,3253  55=562 0            TS      TAU1
0423   REP  2  LAST 1021   17,3254  1 3404 0            TCF     ASMBLWP
```

THE PITCH COMMANDS WILL BE COMPLETED
WITHIN THE TS-CYCLE TIME
FOR USE IN UPDATING RATE FILTER
ZERO TAU1 (ACC CONTAINS ZERO)

L JET SELECTION LOGIC

P0424 YAW JET ON-TIME CALCULATION

```
0425  REF  6  LAST 1012   17,3255  11«563 1  YAWTIME  CCS   TAU2
0426  REF  1              17,3256  1 3265 1           TCF   YTAUPOS
0427                      17,3257  1 3261 0           TCF   +2
0428  REF  1              17,3260  1 3263 1           TCF   YTAUNEG
0429  REF  2  LAST  106   17,3261  55«551 0           TS    DPT2      NO YAW ROTATION COMMANDS
0430  REF  1              17,3262  1 3563 0           TCF   YBYPASS

0431  REF  2  LAST 1013   17,3263  4 1524 1  YTAUNEG  CS    NYJETS
0432  REF  3  LAST 1023   17,3264  55«524 1           TS    NYJETS
0433  REF  7  LAST 1023   17,3265  3 1563 0  YTAUPOS  CA    TAU2
0434                      17,3266  0 0006 1           EXTEND
0435  REF  4  LAST 1023   17,3267  5 1524 0           INDEX NYJETS
0436  REF  2  LAST 1021   17,3270  7 3400 1           MP    NJET
0437  REF  3  LAST  967   17,3271  55«463 0           TS    BLAST2
0438  REF  2  LAST 1021   17,3272  6 3333 1           AD    =-.1SEC
0439                      17,3273  0 0006 1           EXTEND
0440  REF  1              17,3274  6 3305 1           BZMF  AD14MSY
0441  REF  5  LAST 1023   17,3275  51«524 0          INDEX NYJETS
0442  REF  2  LAST 1021   17,3276  3 3334 0           CA    DPTMAX    YAW COMMANDS WILL LAST LONGER THAN .1SEC
0443  REF  3  LAST 1023   17,3277  55«551 0           TS    DPT2
0444                      17,3300  4 0000 0           COM
0445  REF  6  LAST 1023   17,3301  27«563 1           ADS   TAU2      DECREMENT TAU2
0446  REF  2  LAST 1021   17,3302  3 3335 1           CAF   =+.1SEC   LIMIT THE LENGTH OF YAW ROTATION COMMAND
0447  REF  4  LAST 1023   17,3303  55«463 0           TS    BLAST2    TO 0.1 SEC SO THAT ONLY X-TRANSLATION
0448  REF  1              17,3304  1 3550 0           TCF   ASMBLWY   WILL CONTINUE ON SWITCH OVER TO TVC

0449  REF  5  LAST 1023   17,3305  4 1463 0  AD14MSY  CS    BLAST2    SEE IF JET ON-TIME LESS THAN
0450  REF  4  LAST 1021   17,3306  6 3340 0           AD    =14MS     MINIMUM IMPULSE TIME
0451                      17,3307  0 0006 1           EXTEND
0452  REF  1              17,3310  6 3313 0           BZMF  YBLASTOK  IF SO, LIMIT MINIMUM ON-TIME TO 14 MS
0453  REF  5  LAST 1023   17,3311  3 3340 0           CAF   =14MS
0454  REF  6  LAST 1023   17,3312  55«463 0          TS    BLAST2
0455  REF  7  LAST 1023   17,3313  3 1463 1  YBLASTOK CA    BLAST2    YAW COMMANDS WILL BE COMPLETED WITHIN
0456                      17,3314  0 0006 1           EXTEND          THE TSCYCLE TIME
0457  REF  6  LAST 1023   17,3315  7 1524 1           MP    NYJETS
0458  REF  4  LAST 1023   17,3316  23«551 1           LXCH  DPT2
0459  REF  9  LAST 1023   17,3317  55«563 1           TS    TAU2      ZERO TAU2
0460  REF  2  LAST 1023   17,3320  1 3550 0           TCF   ASMBLWY
```

P0461 ROLL ON-TIME CALCULATION-

```
0462  REP  9  LAST 1016   17,3321  11∝561 0  ROLLTIME CCS    TAU
0463  REP  1              17,3322  1 3341 0           TCF    RBLAST
0464                      17,3323  1 3325 1           TCF    +2
0465  REP  2  LAST 1024   17,3324  1 3341 0           TCF    RBLAST
0466  REP  6  LAST 1017   17,3325  51∝522 0           INDEX  NRJETS
0467  REP  3  LAST 1023   17,3326  3 3334 0           CA     DPTMAX
0468  REP  3  LAST  977   17,3327  55∝547 1           TS     DPT
0469  REP  1              17,3330  1 3543 1           TCF    RBYPASS

0470                      17,3331   77037 0           DEC    -460
0471                      17,3332   77277 0           DEC    -320
0472                      17,3333   77537 0  =-.1SEC  DEC    -160
0473                      17,3334   00000 1  DPTMAX   DEC    0
0474                      17,3335   00240 1  =+.1SEC  DEC    160
0475                      17,3336   00500 1           DEC    320
0476                      17,3337   00740 1           DEC    480
0477                      17,3340   00027 1  =14MS    DEC    23

0478  REP  10 LAST 1024   17,3341  3 1561 1  RBLAST   CA     TAU
0479                      17,3342  0 0006 1           EXTEND
0480  REP  7  LAST 1024   17,3343  5 1522 0           INDEX  NRJETS
0481  REP  3  LAST 1023   17,3344  7 3400 1           MP     NJET
0482  REP  2  LAST  100   17,3345  55∝457 1           TS     BLAST
A0483
0484  REP  3  LAST 1023   17,3346  6 3333 1           AD     =-.1SEC
0485                      17,3347  0 0006 1           EXTEND
0486  REP  1              17,3350  6 3361 0           BZMF   AD14MSR
0487  REP  6  LAST 1024   17,3351  51∝522 0           INDEX  NRJETS
0488  REP  4  LAST 1024   17,3352  3 3334 0           CA     DPTMAX
0489  REP  4  LAST 1024   17,3353  55∝547 1           TS     DPT
0490                      17,3354  4 0000 0           COM
0491  REP  11 LAST 1024   17,3355  27∝561 0           ADS    TAU
0492  REP  3  LAST 1023   17,3356  3 3335 1           CAF    =+.1SEC
0493  REP  3  LAST 1024   17,3357  55∝457 1           TS     BLAST
0494  REP  1              17,3360  1 3424 1           TCF    ASMBLWR

0495  REP  4  LAST 1024   17,3361  4 1457 1  AD14MSR  CS     BLAST
0496  REP  6  LAST 1023   17,3362  6 3340 0           AD     =14MS
0497                      17,3363  0 0006 1           EXTEND
0498  REP  1              17,3364  6 3367 0           BZMF   RBLASTOK
0499  REP  7  LAST 1024   17,3365  3 3340 0           CAF    =14MS
0500  REP  5  LAST 1024   17,3366  55∝457 1           TS     BLAST
0501  REP  6  LAST 1024   17,3367  3 1457 0  RBLASTOK CA     BLAST
0502                      17,3370  0 0006 1           EXTEND
0503  REP  9  LAST 1024   17,3371  7 1522 1           MP     NRJETS
0504  REP  5  LAST 1024   17,3372  23∝547 0           LXCH   DPT
0505  REP  12 LAST 1024   17,3373  55∝561 0           TS     TAU
0506  REP  2  LAST 1024   17,3374  1 3424 1           TCF    ASMBLWR
```

UPDATE DPT EVEN THO NO ROLL COMMANDS ARE PRESENT

= -.3SEC
= -.2SEC
= -.1SEC
0
= +.1SEC
= +.2SEC
= +.3SEC
=14MS

BLAST IS AN INTERMEDIATE VARIABLE USED IN DETERMINING THE JET ON-TIMES

THE ROLL ROTATION WILL LAST LONGER THAN THE T5 CYCLE TIME

LIMIT THE LENGTH OF ROLL ROTATION COMMANDS TO 0.1 SEC SO THAT ONLY Y-Z TRANSLATION COMMANDS CONTINUE

SEE IF THE JET ON-TIME LESS THAN MINIMUM IMPULSE TIME

IF SO, LIMIT MINIMUM ON-TIME TO 14 MS

ZERO TAU

```
0507                17,3375  65252 1          DEC   -.333333      = -1/3
0508                17,3376  57777 1          DEC   -.500000      = -1/2
0509                17,3377  40000 0          DEC   -.999999      = -1 (NEGMAX)
0510                17,3400  00000 1  NJET    DEC   0
0511                17,3401  37777 1          DEC   .999999       = +1 (POSMAX)
0512                17,3402  20000 0          DEC   .500000       = +1/2
0513                17,3403  12525 0          DEC   .333333       = +1/3
```

P0514 WHEN THE ROTATION COMMANDS ARE COMPLETED, IT IS NECESSARY TO REPLACE THESE COMMANDS BY NEW COMMANDS WHICH
R0516 CONTINUE ON WITH THE TRANSLATIONS IF ANY ARE PRESENT.
R0517 IN THIS SECTION THESE NEW COMMANDS ARE GENERATED AND STORED FOR REPLACEMENT OF THE CHANNEL COMMANDS WHEN THE
R0519 CORRESPONDING ROTATIONS ARE COMPLETED.

R0520 GENERATION OF THE SECOND PITCH(X-TRANS) WORD...$PWORD_2$

```
0521  REP   8  LAST 1016   17,3404  11=626 0  ASMBLWP  CCS    RACFAIL
0522  REP   1              17,3405  1 3413 0           TCF    FPX2          IF FAILURE ON AC IGNORE X-TRANSLATION
0523                       17,3406  1 3410 0           TCF    +2
0524  REP   2  LAST 1026   17,3407  1 3413 0           TCF    FPX2
0525  REP   7  LAST 1012   17,3410  51=513 1           INDEX  XNDX1
0526  REP   5  LAST 1016   17,3411  3 2705 1           CA     XLNNDX
0527  REP 238  LAST 1016   17,3412  50 000 1           INDEX  A
0528  REP   3  LAST 1013   17,3413  3 2741 1  FPX2     CA     PYTABLE
0529  REP   2  LAST 1012   17,3414  7 2760 0           MASK   PJETS
0530  REP   2  LAST  100   17,3415  55=454 1           TS     PWORD2
0531  REP   1              17,3416  1 3255 1           TCF    YAWTIME

0532  REP   3  LAST 1012   17,3417  3 1453 1  PBYPASS  CA     PWORD1        THE TB PROGRAM WILL LOAD PWORD2
0533  REP   3  LAST 1026   17,3420  55=454 1           TS     PWORD2        UPON ENTRY
0534  REP 185  LAST 1007   17,3421  3 4714 1           CAF    ZERO
0535  REP   8  LAST 1022   17,3422  55=461 1           TS     BLAST1        THERE IS NO PWORD2
0538  REP   2  LAST 1026   17,3423  1 3255 1           TCF    YAWTIME
```

P0537 GENERATION OF THE SECOND ROLL (Y,Z) WORD (RWORD2)

```
0538  REP   6  LAST 1016   17,3424  11'515 0  ASMBLWR  CCS   YNDX      CHECK FOR Y-TRANS
0539  REP   1               17,3425  1 3435 1          TCF   ACBD2Y
0540  REP 186  LAST 1026   17,3426  3 4714 1  NO2Y     CAP   ZERO
0541  REP   2  LAST  100   17,3427  55'452 1          TS    RWORD2
0542  REP   7  LAST 1016   17,3430  11'516 0          CCS   ZNDX      CHECK FOR Z-TRANS
0543  REP   1               17,3431  1 3500 0          TCF   ACBD2Z
0544  REP 187  LAST 1027   17,3432  3 4714 1  NO2Z     CAP   ZERO
0545  REP   3  LAST 1027   17,3433  27'452 1          ADS   RWORD2
0546  REP   1               17,3434  1 3211 1          TCF   PITCHTIM   RWORD2 ASSEMBLED

0547  REP   4  LAST 1014   17,3435  11'630 1  ACBD2Y   CCS   ACORBD
0548  REP   1               17,3436  1 3453 1          TCF   AC2Y      CAN DO Y-TRANS
0549  REP   2  LAST 1027   17,3437  1 3453 1          TCF   AC2Y
0550                        17,3440  1 3441 1          TCF   +1        USING AC FOR ROLL
0551  REP   9  LAST 1026   17,3441  11'626 0          CCS   RACFAIL
0552  REP   1               17,3442  1 3426 0          TCF   NO2Y      USING AC AND AC HAS FAILED
0553                        17,3443  1 3445 0          TCF   +2
0554  REP   2  LAST 1027   17,3444  1 3426 0          TCF   NO2Y      DITTO

0555  REP   9  LAST 1027   17,3445  51'515 1          INDEX YNDX      NO FAILURES, CAN DO Y
0556  REP   6  LAST 1026   17,3446  3 2705 1          CA    XLNNDX
0557  REP 239  LAST 1026   17,3447  50 000 1          INDEX A
0558  REP   3  LAST 1016   17,3450  3 3155 0          CA    RTABLE
0559  REP   2  LAST 1014   17,3451  7 3174 1          MASK  ACRJETS
0560  REP   3  LAST 1027   17,3452  1 3427 1          TCF   NO2Y +1

0561  REP  10  LAST 1027   17,3453  11'626 0  AC2Y     CCS   RACFAIL
0562  REP  36  LAST 1016   17,3454  3 6214 0          CAP   THREE
0563                        17,3455  1 3457 0          TCF   +2
0564  REP  33  LAST 1016   17,3456  3 6211 0          CAP   SIX
0565  REP  10  LAST 1027   17,3457  51'515 1          INDEX YNDX
0566  REP   3  LAST 1016   17,3460  6 3016 0          AD    XLN1NDX
0567  REP 240  LAST 1027   17,3461  50 000 1          INDEX A
0568  REP   3  LAST 1016   17,3462  3 3176 1          CA    YZTABLE
0569  REP   2  LAST 1016   17,3463  7 3210 0          MASK  ACYJETS
0570  REP   4  LAST 1027   17,3464  55'452 1          TS    RWORD2
0571                        17,3465  0 0006 1          EXTEND
0572  REP  37  LAST 1017   17,3466  7 4707 1          MP    BIT4
0573  REP   3  LAST 1017   17,3467  6 7715 0          AD    =-2
0574  REP  10  LAST 1024   17,3470  55'522 1          TS    NRJETS
0575  REP   7  LAST 1024   17,3471  4 1457 1          CS    BLAST
0576  REP   4  LAST 1024   17,3472  6 3335 1          AD    =+.1SEC
0577                        17,3473  0 0006 1          EXTEND
0578  REP  11  LAST 1027   17,3474  7 1522 1          MP    NRJETS
0579  REP 129  LAST  996   17,3475  3 0001 0          CA    L
0580  REP   6  LAST 1024   17,3476  27'547 1          ADS   DPT
0581  REP   4  LAST 1027   17,3477  1 3430 1          TCF   NO2Y +2
```

L JET SELECTION LOGIC


```
0562  REF   5  LAST 1027   17,3500  11'630 1  ACBD2Z  CCS    ACORBD
0563  REF   1               17,3501  1 3531 1          TCF    BDF2Z      USING BD-ROLL
0564  REF   2  LAST 1026   17,3502  1 3531 1          TCF    BDF2Z      MUST CHECK FOR BD FAILURES
0565                        17,3503  1 3504 1          TCF    +1
0566  REF   6  LAST 1016   17,3504  11'627 1          CCS    RBDFAIL    USING AC FOR ROLL, CAN DO Z-TRANS
0567  REF  37  LAST 1027   17,3505  3 6214 0          CAF    THREE
0566                        17,3506  1 3510 1          TCF    +2
0569  REF  34  LAST 1027   17,3507  3 6211 0          CAF    SIX
0590  REF   6  LAST 1027   17,3510  51'516 1          INDEX  ZNDX
0591  REF   4  LAST 1027   17,3511  6 3016 0          AD     XLN1NDX
0592  REF 241  LAST 1027   17,3512  50 000 1          INDEX  A
0593  REF   4  LAST 1027   17,3513  3 3176 1          CA     YZTABLE
0594  REF   2  LAST 1015   17,3514  7 3207 0          MASK   BDZJETS
0595  REF   5  LAST 1027   17,3515  27'452 1          ADS    RWORD2
0598                        17,3516  0 0006 1          EXTEND
0597  REF  48  LAST 1015   17,3517  7 4704 1          MP     BIT7
0598  REF   4  LAST 1027   17,3520  8 7715 0          AD     =-2
0599  REF  12  LAST 1027   17,3521  55'522 1          TS     NRJETS
0800  REF   6  LAST 1027   17,3522  4 1457 1          CS     BLAST
0601  REF   5  LAST 1027   17,3523  6 3335 1          AD     =+.1SEC
0602                        17,3524  0 0006 1          EXTEND
0603  REF  13  LAST 1026   17,3525  7 1522 1          MP     NRJETS
0604  REF 130  LAST 1027   17,3526  3 0001 0          CA     L
0605  REF   7  LAST 1027   17,3527  27'547 1          ADS    DFT
0608  REF   2  LAST 1027   17,3530  1 3211 1          TCF    PITCHTIM

0607  REF   9  LAST 1026   17,3531  11'627 1  BDF2Z   CCS    RBDFAIL
0608  REF   1               17,3532  1 3432 0          TCF    NO2Z       USING BD-ROLL AND BD HAS FAILED
0609                        17,3533  1 3535 0          TCF    +2
0810  REF   2  LAST 1028   17,3534  1 3432 0          TCF    NO2Z       DITTO
0611  REF   9  LAST 1028   17,3535  51'516 1          INDEX  ZNDX
0612  REF   7  LAST 1027   17,3536  3 2705 1          CA     XLNNDX
0613  REF 242  LAST 1026   17,3537  50 000 1          INDEX  A
0614  REF   4  LAST 1027   17,3540  3 3155 0          CA     RTABLE
0615  REF   2  LAST 1016   17,3541  7 3175 0          MASK   BDRJETS
0616  REF   3  LAST 1026   17,3542  1 3433 1          TCF    NO2Z +1

0617  REF  11  LAST 1017   17,3543  3 1451 0  RBYPASS CA     RWORD1
0618  REF   6  LAST 1026   17,3544  55'452 1          TS     RWORD2
0819  REF 188  LAST 1027   17,3545  3 4714 1          CAF    ZERO
0620  REF   9  LAST 1026   17,3546  55'457 1          TS     BLAST
0621  REF   3  LAST 1028   17,3547  1 3211 1          TCF    PITCHTIM
```

P0622 GENERATION OF THE SECOND YAW (X-TRANS) WORD...YWORD2

```
0623  REP  10  LAST 1026   17,3550  11=627 1  ASMBLWY  CCS    RBDFAIL
0624  REP   1              17,3551  1 3557 1           TCF    FYX2
0625                       17,3552  1 3554 1           TCF    +2
0626  REP   2  LAST 1029   17,3553  1 3557 1           TCF    FYX2
0627  REP   6  LAST 1013   17,3554  51=514 0           INDEX  XNDX2
0628  REP   8  LAST 1028   17,3555  3 2705 1           CA     XLNNDX
0629  REP 243  LAST 1026   17,3556  50 000 1           INDEX  A
0630  REP   4  LAST 1026   17,3557  3 2741 1  FYX2     CA     PYTABLE
0631  REP   2  LAST 1013   17,3560  7 2761 1           MASK   YJETS
0632  REP   2  LAST  100   17,3561  55=456 0           TS     YWORD2
0633  REP   1              17,3562  1 3567 1           TCF    TBSETUP

0634  REP   3  LAST 1013   17,3563  3 1455 1  YBYPASS  CA     YWORD1
0635  REP   3  LAST 1029   17,3564  55=456 0           TS     YWORD2
0636  REP 189  LAST 1028   17,3565  3 4714 1           CAF    ZERO
0637  REP   8  LAST 1023   17,3566  55=463 0           TS     BLAST2
```

IF FAILURE ON BD IGNORE X-TRANSLATION

P0636 SORT THE JET ON-TIMES

R0639 AT THIS POINT ALL THE CHANNEL COMMANDS AND JET ON-TIMES HAVE BEEN DETERMINED. IN SUMMARY THESE ARE-

R0641 RWORD$_1$
R0642 RWORD$_2$ BLAST

R0643 PWORD$_1$
R0644 PWORD$_2$ BLAST$_1$

R0645 YWORD$_1$
R0646 YWORD$_2$ BLAST$_2$

R0647 IN THIS SECTION THE JET ON-TIMES ARE SORTED AND THE SEQUENCE OF T6 INTERRUPTS IS DETERMINED. TO FACILITATE
R0649 THE SORTING PROCESS AND THE T6 PROGRAM, THE VARIABLES BLAST, BLAST1, BLAST2, ARE RESERVED AS DOUBLE PRECISION
R0651 WORDS. THE LOWER PART OF THESE WORDS CONTAIN A BRANCH INDEX ASSOCIATED WITH THE ROTATION AXIS OF THE HIGHER
R0653 ORDER WORD.

```
0654  REP 190  LAST 1029   17,3567  3 4714 1  T6SETUP  CAF   ZERO       BRANCH INDEX FOR ROLL
0655  REP  10  LAST 1026   17,3570  55∝460 0           TS    BLAST +1
0656  REP  14  LAST 1001   17,3571  3 4710 0           CAF   FOUR       BRANCH INDEX FOR PITCH
0657  REP   9  LAST 1026   17,3572  55∝462 1           TS    BLAST1 +1
0658  REP   6  LAST  987   17,3573  3 4717 1           CAF   ELEVEN     BRANCH INDEX FOR YAW
0659  REP   9  LAST 1029   17,3574  55∝464 1           TS    BLAST2 +1

0660  REP  11  LAST 1030   17,3575  4 1457 1           CS    BLAST
0661  REP  10  LAST 1030   17,3576  6 1461 0           AD    BLAST1
0662                       17,3577  0 0006 1           EXTEND
0663  REP   1              17,3600  6 3624 1           BZMF  DXCHT12    T1 GR T2
0664  REP  11  LAST 1030   17,3601  4 1461 1  CHECKT23 CS    BLAST1
0665  REP  10  LAST 1030   17,3602  6 1463 1           AD    BLAST2
0666                       17,3603  0 0006 1           EXTEND
0667  REP   1              17,3604  6 3630 1           BZMF  DXCHT23
0668  REP  12  LAST 1030   17,3605  4 1461 1  CALCDT6  CS    BLAST1
0669  REP  11  LAST 1030   17,3606  27∝463 0           ADS   BLAST2
0670  REP  12  LAST 1030   17,3607  4 1457 1           CS    BLAST
0671  REP  13  LAST 1030   17,3610  27∝461 1           ADS   BLAST1    END OF SORTING PROCEDURE
0672                       17,3611  0 0006 1           EXTEND           RESET T5LOC TO BEGIN PHASE1
0673  REP   1              17,3612  3 3623 0           DCA   RCS2CADR
0674  REP  21  LAST 1007   17,3613  53∝313 0           DXCH  T5LOC
0675  REP  69  LAST  987   17,3614  4 4712 0  ENDJETS  CS    BIT1       RESET BIT1 FOR INITIALIZATION OF
0676  REP  47  LAST 1004   17,3615  7 1501 0           MASK  RCSFLAGS   T6 PROGRAM
0677  REP  46  LAST 1030   17,3616  55∝501 0           TS    RCSFLAGS
0678  REP 191  LAST 1030   17,3617  4 4714 0           CS    ZERO       RESET T5PHASE FOR PHASE1
0679  REP  10  LAST  993   17,3620  55∝465 0           TS    T5PHASE
0680  REP  40  LAST 1007   17,3621  1 5222 1           TCF   RESUME     RESUME INTERRUPTED PROGRAM
0681  REP  36  LAST 1010   E6,1510                    EBANK= KMPAC
0682  REP   5  LAST  973   17,3622   02106 1  RCS2CADR 2CADR RCSATT
0682                       17,3623   42066 1
```

```
0663   REP  13  LAST 1030   17,3624  53=460 0  DXCHT12  DXCH   BLAST
0664   REP  14  LAST 1030   17,3625  53=462 1           DXCH   BLAST1
0665   REP  14  LAST 1031   17,3626  53=460 0           DXCH   BLAST
0666   REP   1              17,3627  1 3801 1           TCF    CHECKT23

0667   REP  15  LAST 1031   17,3630  53=462 1  DXCHT23  DXCH   BLAST1
0668   REP  12  LAST 1030   17,3631  53=464 1           DXCH   BLAST2
0669   REP  18  LAST 1031   17,3632  53=462 1           DXCH   BLAST1
0690   REP  15  LAST 1031   17,3633  4 1457 1           CS     BLAST
0691   REP  17  LAST 1031   17,3634  6 1461 0           AD     BLAST1
0692                        17,3635  0 0006 1           EXTEND
0693                        17,3636  6 3640 0           BZMF   +2
0694   REP   1              17,3637  1 3605 0           TCF    CALCDT6
0695   REP  16  LAST 1031   17,3640  53=460 0           DXCH   BLAST
0696   REP  18  LAST 1031   17,3641  53=462 1           DXCH   BLAST1
0697   REP  17  LAST 1031   17,3642  53=460 0           DXCH   BLAST
0698   REP   2  LAST 1031   17,3643  1 3605 0           TCF    CALCDT6
```

P0699 T6 PROGRAM AND CHANNEL SETUP

```
0700
0701  REF   1                 21,3751                         BANK    21
0702                          17,2000                         SETLOC  DAPS5
                              17,3644                         BANK

0703  REF  19  LAST 1010     17,3644  22 016 0  T6START  LXCH    BANKRUPT
0704                          17,3645  0 0006 1           EXTEND
0705  REF  15  LAST 1010     17,3646  22 012 1           QXCH    QRUPT
0706  REF   5  LAST 1010     17,3647  10 031 1           CCS     TIME6
0707  REF  41  LAST 1030     17,3650  1 5222 1           TCF     RESUME
0708                          17,3651  1 3653 0           TCF     +2
0709  REF  42  LAST 1032     17,3652  1 5222 1           TCF     RESUME

0710  REF  49  LAST 1030     17,3653  4 1501 0           CS      RCSFLAGS
0711  REF  70  LAST 1030     17,3654  7 4712 0           MASK    BIT1
0712                          17,3655  0 0006 1           EXTEND
0713  REF   1                 17,3656  1 3667 1           BZF     T6RUPTOR
0714  REF  50  LAST 1032     17,3657  27=501 0           ADS     RCSFLAGS
0715  REF  12  LAST 1028     17,3660  3 1451 0           CA      RWORD1
0716                          17,3661  0 0006 1           EXTEND
0717  REF   7  LAST  959     17,3662  01 006 0           WRITE   CHAN6
0718  REF   4  LAST 1026     17,3663  3 1453 1           CA      PWORD1
0719  REF   4  LAST 1029     17,3664  6 1455 1           AD      YWORD1
0720                          17,3665  0 0006 1           EXTEND
0721  REF   3  LAST  652     17,3666  01 005 0           WRITE   CHAN5

0722  REF  18  LAST 1031     17,3667  11=457 1  T6RUPTOR CCS     BLAST
0723  REF   1                 17,3670  1 3747 1           TCF     ZBLAST
0724  REF   1                 17,3671  1 3706 1           TCF     REPLACE
0725                          17,3672  1 3674 0           TCF     +2
0726  REF   2  LAST 1032     17,3673  1 3706 1           TCF     REPLACE
0727  REF  19  LAST 1031     17,3674  11=461 1  T6L1     CCS     BLAST1
0728  REF   1                 17,3675  1 3752 0           TCF     ZBLAST1
0729  REF   1                 17,3676  1 3713 0           TCF     REPLACE1
0730                          17,3677  1 3701 0           TCF     +2
0731  REF   2  LAST 1032     17,3700  1 3713 0           TCF     REPLACE1
0732  REF  13  LAST 1031     17,3701  11=463 0  T6L2     CCS     BLAST2
0733  REF   1                 17,3702  1 3755 1           TCF     ZBLAST2
0734  REF   1                 17,3703  1 3720 0           TCF     REPLACE2
0735  REF  43  LAST 1032     17,3704  1 5222 1           TCF     RESUME
0736  REF   2  LAST 1032     17,3705  1 3720 0           TCF     REPLACE2

0737  REF  19  LAST 1032     17,3706  51=460 1  REPLACE  INDEX   BLAST +1
0738  REF   1                 17,3707  0 3725 1           TC      REPLACER
0739  REF 110  LAST 1014     17,3710  4 4712 0           CS      ONE
0740  REF  20  LAST 1032     17,3711  55=457 1           TS      BLAST
0741  REF   1                 17,3712  1 3674 0           TCF     T6L1

0742  REF  20  LAST 1032     17,3713  51=462 0  REPLACE1 INDEX   BLAST1 +1
```

CHECK TO SEE IF TIME6 WAS RESET
AFTER T6RUPT OCCURED(IN T5RUPT)
IF SO WAIT FOR NEXT T6RUPT BEFORE
TAKING ACTION

IF BIT1 IS 0 RESET TO 1
AND INITIALIZE CHANNEL

INITIALIZE CHANNELS 5,6 WITH WORD1

ZERO BLAST1
REPLACE WORD1

```
0743  REP   2  LAST 1032   17,3714  0 3725 1          TC      REPLACER
0744  REP 111  LAST 1032   17,3715  4 4712 0          CS      ONE
0745  REP  21  LAST 1032   17,3716  55=461 1          TS      BLAST1
0746  REP   1              17,3717  1 3701 0          TCF     T6L2

0747  REP  14  LAST 1032   17,3720  51=464 0 REPLACE2 INDEX   BLAST2 +1
0748  REP   3  LAST 1033   17,3721  0 3725 1          TC      REPLACER
0749  REP 112  LAST 1033   17,3722  4 4712 0          CS      ONE
0750  REP  15  LAST 1033   17,3723  55=463 0          TS      BLAST2
0751  REP  44  LAST 1032   17,3724  1 5222 1          TCF     RESUME

0752  REP   7  LAST 1028   17,3725  3 1452 0 REPLACER CA      RWORD2
0753                        17,3726  0 0006 1          EXTEND
0754  REP   8  LAST 1032   17,3727  01 006 0          WRITE   CHAN6
0755  REP 200  LAST  992   17,3730  0 0002 0          TC      Q

0756  REP   3  LAST 1029   17,3731  3 2761 0 REPLACEP CA      YJETS
0757                        17,3732  0 0006 1          EXTEND
0758  REP   4  LAST 1032   17,3733  02 005 0          RAND    CHAN5
0759  REP   4  LAST 1026   17,3734  6 1454 0          AD      PWORD2
0760                        17,3735  0 0006 1          EXTEND
0761  REP   5  LAST 1033   17,3736  01 005 0          WRITE   CHAN5
0762  REP 201  LAST 1033   17,3737  0 0002 0          TC      Q

0763  REP   3  LAST 1026   17,3740  3 2760 1 REPLACEY CA      PJETS
0764                        17,3741  0 0006 1          EXTEND
0765  REP   6  LAST 1033   17,3742  02 005 0          RAND    CHAN5
0766  REP   4  LAST 1029   17,3743  6 1456 1          AD      YWORD2
0767                        17,3744  0 0006 1          EXTEND
0768  REP   7  LAST 1033   17,3745  01 005 0          WRITE   CHAN5
0769  REP 202  LAST 1033   17,3746  0 0002 0          TC      Q

0770  REP 192  LAST 1030   17,3747  3 4714 1 ZBLAST   CAF     ZERO
0771  REP  21  LAST 1032   17,3750  57=457 0          XCH     BLAST
0772  REP   1              17,3751  1 3757 0          TCF     ENABT6
0773  REP 193  LAST 1033   17,3752  3 4714 1 ZBLAST1  CAF     ZERO
0774  REP  22  LAST 1033   17,3753  57=461 0          XCH     BLAST1
0775  REP   2  LAST 1033   17,3754  1 3757 0          TCF     ENABT6
0776  REP 194  LAST 1033   17,3755  3 4714 1 ZBLAST2  CAF     ZERO
0777  REP  16  LAST 1033   17,3756  57=463 1          XCH     BLAST2
0778  REP   6  LAST 1032   17,3757  54 031 1 ENABT6   TS      TIME6
0779  REP  10  LAST 1010   17,3760  3 4674 0          CAF     NEGMAX
0780                        17,3761  0 0006 1          EXTEND
0781  REP  11  LAST 1010   17,3762  05 013 0          WOR     CHAN13      ENABLE T6RUPT
0782  REP  45  LAST 1033   17,3763  1 5222 1          TCF     RESUME

R0783                 END OF T6 INTERRUPT

0784                        17,3764           ENDSLECT EQUALS
```

R0001 SUBROUTINE TO READ GYMBAL ANGLES AND FORM DIFFERENCES. GIMBAL ANGLES ARE SAVED IN 2S COMPLEMENT, BUT THE
R0003 DIFFERENCES ARE IN 1S COMP. ENTER AND READ ANGLES EACH .1 SEC.

R0004 CM/DSTBY = 1 FOR DAP OPERATION
R0005 CM/DSTBY = 0 TO TERMINATE DAP OPERATION.

```
0006                                15,2454                 BANK   15

0007  REF   1                       15,2000                 SETLOC ETRYDAP
0008                                15,2454                 BANK

0009  REF   1                                               COUNT  15/DAPEN

0010  REF  29  LAST  642           E6,1661                 EBANK= ACG

0011  REF   6  LAST  960  15,2454  3 4377 0  READGYMB CA     TEN          KEEP RESTART DT GOING RELATIVE TO
0012  REF   5  LAST  779  15,2455  27=725 1            ADS    CM/GYMDT     PIPTIME. (GROUP 6)

A0013                                                       IF A RESTART OCCURS, SKIP PRESENT CYCLE. THE
A0014                                                       PHASCHNG PROTECTION IS IN CM/DAPIC.

0015  REF  42  LAST  993  15,2456  3 4705 1            CA     BIT6         CHECK FOR FINE ALIGN MODE OF CDU.
0016  REF  26  LAST  966  15,2457  7 1321 1            MASK   IMODES33     ( PROTECT ACG/PIP ETC AS WELL AS
0017                      15,2460  0 0006 1            EXTEND              GIMBAL DIFFERENCES)
0018  REF   1             15,2461  1 2467 1            BZF    READGYM1     OK

0019  REF  71  LAST 1032  15,2462  4 4712 0            CS     BIT1         NOT IN FINE ALIGN, SO IDLE.
0020  REF  10  LAST  840  15,2463  7 0102 0            MASK   CM/FLAGS     SET GYMDIPSW =0
0021  REF  11  LAST 1034  15,2464  54 102 0            TS     CM/FLAGS
0022  REF   1             15,2465  0 6000 1            TC     FLUSHJET     QUENCH JETS, SINCE MAY BE A WHILE.
0023  REF   1             15,2466  0 2534 1            TC     CM/GYMIC +2

0024  REF  27  LAST 1006  15,2467  3 0032 0  READGYM1 CA     CDUX
0025  REF  30  LAST 1034  15,2470  57=661 1           XCH    ACG
0026                      15,2471  0 0006 1            EXTEND
0027  REF  31  LAST 1034  15,2472  21=661 0           MSU    ACG          -DELACG=ACG(N-1) - ACG(N)
0028  REF   2  LAST  109  15,2473  55=675 0           TS     -DELACG

0029  REF  15  LAST  996  15,2474  3 0033 1            CA     CDUY
0030  REF   2  LAST  109  15,2475  57=662 1           XCH    AIG
0031                      15,2476  0 0006 1            EXTEND
0032  REF   3  LAST 1034  15,2477  21=662 0           MSU    AIG
0033  REF   2  LAST  109  15,2500  55=676 0           TS     -DELAIG

0034  REF  21  LAST 1006  15,2501  3 0034 0            CA     CDUZ
0035  REF   3  LAST  776  15,2502  57=663 0           XCH    AMG
0036                      15,2503  0 0006 1            EXTEND
0037  REF   4  LAST 1034  15,2504  21=663 1           MSU    AMG
0038  REF   2  LAST  109  15,2505  55=677 1           TS     -DELAMG
```

L CM ENTRY DIGITAL AUTOPILOT

```
0039  REF  12  LAST 1034   15,2506  4 0102 0  DOBRATE1  CS    CM/FLAGS     CM/DSTBY=103D BIT2  GYMDIPSW=104D BIT1
0040  REF  38  LAST 1028   15,2507  7 6214 1            MASK  THREE
0041  REF 244  LAST 1029   15,2510  50 000 1            INDEX A
0042                       15,2511  0 2512 0            TC    +1
0043  REF   1              15,2512  0 2521 0            TC    DOBRATE      OK, GO ON
0044  REF   2  LAST 1034   15,2513  0 2532 1            TC    CM/GYMIC     DONT CALC BODYRATE ON FIRST PASS.
0045                       15,2514  12 515 0            NOOP
0046  REF   2  LAST 1034   15,2515  0 6000 1            TC    PLUSHJET     TURN OFF ALL JETS

0047  REF  86  LAST  644   15,2516  0 5301 0            TC    PHASCHNG
0048                       15,2517   00006 1            OCT   00006        DEACTIVATE DAP GROUP 6.

0049  REF  50  LAST  958   15,2520  0 5213 1            TC    TASKOVER

0050  REF 113  LAST 1033   15,2521  3 4712 1  DOBRATE   CA    ONE          DO BODYRATE
0051  REF   2  LAST  110   15,2522  55=720 1  DOBRATE1  TS    JETEM        SKIP BODYRATE.

0052  REF   7  LAST 1034   15,2523  3 4377 0            CA    TEN          KEEP CDU READ GOING.
0053  REF  46  LAST  946   15,2524  0 5140 1            TC    WAITLIST
0054  REF  32  LAST 1034   E6,1661                      EBANK= ACG
0055  REF   2  LAST  213   15,2525   02454 0            2CADR READGYMB
0055                       15,2526   32066 0

A0056                                                        DOES NOT PROTECT TEMK, SQ IN SPSIN/COS

0057  REF   3  LAST 1035   15,2527  11=720 1            CCS   JETEM
0058  REF   1              15,2530  0 2556 0            TC    BODYRATE
0059  REF  51  LAST 1035   15,2531  0 5213 1            TC    TASKOVER     SKIP CALC ON INITIAL PASS. (PASSES)

0060  REF  13  LAST 1035   15,2532  26 102 0  CM/GYMIC  ADS   CM/FLAGS     GYMDIPSW' C(A)=1, KNOW BIT IS 0
0061  REF 195  LAST 1033   15,2533  3 4714 1            CAF   ZERO
0062  REF   2  LAST  109   15,2534  55=711 0            TS    JETAG
0063  REF   2  LAST  109   15,2535  55=706 0            TS    OLDELP
0064  REF   2  LAST  109   15,2536  55=707 1            TS    OLDELQ
0065  REF   2  LAST  109   15,2537  55=710 1            TS    OLDELR
0066  REF   4  LAST  840   15,2540  55=723 1            TS    GAMDOT       NO GYM DIF, PROB NO GAM DIF.
0067  REF   1              15,2541  0 2522 0            TC    DOBRATE1
```

```
L       CM ENTRY DIGITAL AUTOPILOT

P0068   COME HERE TO CORRECT FOR OVERFLOW IN ANGULAR CALCULATIONS

0069    REP 131  LAST 1028    15,2542  54 001 1  ANGOVCOR TS      L        THIS COSTS 2 MCT TO USE.
0070    REP 203  LAST 1033    15,2543  0 0002 0            TC      Q        NO OVFL
0071    REP 245  LAST 1035    15,2544  50 000 1            INDEX   A
0072    REP   4  LAST  956    15,2545  3 4873 1            CAF     LIMITS
0073    REP 132  LAST 1036    15,2548  26 001 1            ADS     L
0074    REP 204  LAST 1036    15,2547  0 0002 0            TC      Q

0075                             6000                      BLOCK   3

0076    REP   1                                            COUNT   03/DAPEN

0077                             6000  3 0007 0  FLUSHJET  CA      7        COME HERE TO TURN OFF ALL JETS.
0078                             6001  0 0008 1            EXTEND
0079    REP   1                  6002  01 008 0            WRITE   ROLLJETS ZERO CHANNEL 6
0080                             6003  0 0008 1            EXTEND
0081    REP   1                  6004  01 005 0            WRITE   PYJETS   ZERO CHANNEL 5
0082    REP 205  LAST 1036       6005  0 0002 0            TC      Q

0083                          15,2550                      BANK    15

0084    REP   2 LAST 1034 TO 1038'    80    60*           COUNT   15/DAPEN

0085    REP   2  LAST 1034    15,2000                      SETLOC  ETRYDAP
0086                          15,2550                      BANK

0087                          15,2550  4 0000 0  RATEAVG   COM
0088    REP   4  LAST 1035    15,2551  6 1720 0            AD      JETEM    SUBROUTINE TO ESTIMATE RATES IN PRESENCE
0096                          15,2552  0 0006 1            EXTEND           OF CONSTANT ACCELERATION.
0097    REP   3  LAST  436    15,2553  7 4675 0            MP      HALF     DELV (EST) = DELV +(DELV-OLDELV)/2
0098    REP   5  LAST 1036    15,2554  6 1720 0            AD      JETEM
0099    REP 206  LAST 1036    15,2555  0 0002 0            TC      Q
```

```
P0101   THESE ARE CALLED FOR THE VARIOUS INITIALIZATIONS NEEDED.

0102                        20,3565                         BANK    20
0103    REF   1             20,2000                         SETLOC  DAPS1
0104                        20,3565                         BANK

0105    REF   1                                             COUNT   20/DAPEN

0106    REF  33  LAST 1035  E6,1661                         EBANK=  ACCG

0107    REF   3  LAST  641  20,3565  3 4752 0  CM/DAPON    CA      EBACG
0108    REF  40  LAST  841  20,3566  54 003 0               TS      EBANK

0109    REF  52  LAST  783  20,3567  0 5447 0               TC      DOWNFLAG        RESET DAPBIT1.  T5 RESTART IDENTIFIER.
01095   REF   2  LAST  690  20,3570   00132 1               ADRES   DAPBIT1         BIT 15  FLAG 6          CM FLAGS.
0110    REF  53  LAST 1037  20,3571  0 5447 0               TC      DOWNFLAG        RESET DAPBIT2
01105   REF   2  LAST  690  20,3572   00133 0               ADRES   DAPBIT2         BIT 14  FLAG 6
0111                        20,3573  0 0006 1               EXTEND
0112    REF   1             20,3574  3 3712 0               DCA     T5IDLER1        DISABLE RCS CALCULATION
0113    REF  22  LAST 1030  20,3575  53=313 0               DXCH    T5LOC
0114                        20,3576  0 0006 1               EXTEND
0115    REF   2  LAST 1037  20,3577  3 3712 0               DCA     T5IDLER1        DISABLE RCS JET CALLS
0116    REF   4  LAST  987  20,3600  53=311 1               DXCH    T6LOC

0117    REF   3  LAST 1035  20,3601  0 6000 1               TC      FLUSHJET        JETS DEPARTED  ON SM. ZERO JET BITS.

0118    REF   5  LAST  983  20,3602  4 7707 1               CS      13,14,15
0119    REF  71  LAST 1010  20,3603  7 1466 0               MASK    DAPDATR1        SET  CONFIG  BITS =0 FOR ENTRY
0120    REF  72  LAST 1037  20,3604  55=466 0               TS      DAPDATR1
0121                        20,3605  0 3611 1               TC      +4

0122    REF   6  LAST  904  20,3606  3 4731 0  NOTYET      CA      .5SEC
0123    REF 245  LAST  691  20,3607  0 4555 0               TC      BANKCALL
0124    REF  13  LAST  866  20,3610   01732 0               CADR    DELAYJOB        (DELAYJOB DOES INHINT)
0125    REF  30  LAST 1006  20,3611  3 4700 1  +4          CA      BIT11           GAMDIFSW = 94D  BIT11,   INITLY=0
0126    REF  14  LAST 1035  20,3612  7 0102 0               MASK    CM/FLAGS        IF ZERO, WAIT UNTIL CM/POSE UPDATE.
0127                        20,3613  0 0006 1               EXTEND
0128    REF   1             20,3614  1 3606 0               BZF     NOTYET

0129    REF 114  LAST 1035  20,3615  4 4712 0               CS      ONE             ACTIVATE CM/DAP
0130    REF  51  LAST 1032  20,3616  55=501 0               TS      RCSFLAGS        USE BIT3 TO INITIALIZE NEEDLER ON
A0131                                                                               NEXT PASS.
0132    REF   3  LAST  749  20,3617  55=727 0               TS      P63FLAG         SO WAKEP62 WILL NOT BE INITIATED UNTIL
A0133                                                                               HEADSUP IS SET IN P62.
A0134                                                                   FLAG TO PREVENT MULTIPLE CALLS TO WAKEP62.

0135                        20,3620  3 0007 0               CA      7
0136    REF   3  LAST 1035  20,3621  55=711 0               TS      JETAG
01361   REF   3  LAST  173  20,3622  55=713 1               TS      PAXERR1         KEEP NEEDLES ZERO UNTIL DAP UPDATE
A01362                                                                              IN CASE CMDAPMOD IS NOT +1.
```

```
0137                          20,3623  0 0004 0    INHINT
0138                          20,3624  0 0006 1    EXTEND
0139  REP   4  LAST  841      20,3625  3 1666 0    DCA     ALFA/160        DO ATTITUDE HOLD UNTIL KEYBOARD
0140  REP   3  LAST  747      20,3626  53'604 0    DXCH    ALFACOM         ESTABLISHES HEADSUP.
0141  REP   5  LAST  641      20,3627  3 1664 1    CA      ROLL/160
0142  REP   2  LAST  110      20,3630  55'717 0    TS      ROLLHOLD        FOR ATTITUDE HOLD IN MODE +1.
0143                          20,3631  0 0006 1    EXTEND
0144  REP   4  LAST 1036      20,3632  7 4675 0    MP      HALF
0145  REP  12  LAST  627      20,3633  55'715 1    TS      ROLLC           NOT INTERESTED IN LO WORD.

0146  REP  15  LAST 1037      20,3634  4 0102 0    CS      CM/FLAGS
0147  REP  28  LAST  932      20,3635  7 4677 1    MASK    BIT12           CMDAPARM =93D BIT12  INITLY=0
0148  REP  16  LAST 1038      20,3636  28 102 0    ADS     CM/FLAGS        SET BIT TO 1.

0149  REP  16  LAST  777      20,3637  4 0076 1    CS      FLAGWRD2        SET NODOFLAG  TO PREVENT FURTHER
0150  REP  72  LAST 1034      20,3640  7 4712 0    MASK    BIT1            V 37 ENTRIES.
0151  REP  17  LAST 1036      20,3641  28 076 1    ADS     FLAGWRD2

0152                          20,3642  0 0003 1    RELINT

0153  REP  58  LAST  989      20,3643  0 4574 0    TC      POSTJUMP
0154  REP   1                 20,3644   54342 0    CADR    P62.1
```

```
P0155   INITIALIZE CM/DAP.   WAITLIST CALL FOR READGYMB.  SET SWITCH CM/DSTBY =1
R0156   SO READACCS WILL ENTER A WTLST CALL FOR  SETJTAG .
R0157    CMDAPARM  = 0    , SO ONLY BODY RATE AND ATTITUDE CALCULATIONS ARE DONE.
R0158   SET AVEGEXIT TO CONTINUE AT CM/POSE
R0159

 0160   REF   4  LAST 1037   20,3645  3 4752 0  CM/DAPIC CA     EBACG
 0161   REF  41  LAST 1037   20,3646  54 003 0           TS     EBANK

 0162                        20,3647  0 0004 0           INHINT
 0163   REF  15  LAST  803   20,3650  4 1205 0  CM/DAP2C CS     PIPTIME +1
A0164                                                           PRIO OF P62 L PRIO AVG,'PIPTM=PIPTM1
 0165   REF   6  LAST 1036   20,3651  55#720 1           TS     JETEM

 0166   REF   1              20,3652  3 4675 1           CA     POS1/2
 0167   REF   2  LAST 1039   20,3653  6 4675 1           AD     POS1/2
 0168   REF  14  LAST  724   20,3654  6 0025 0           AD     TIME1        OVFL GUARANTEED
 0169   REF   7  LAST 1039   20,3655  27#720 1           ADS    JETEM        C(A) = DELTA TIME SINCE PIPUP

 0170   REF  25  LAST  989   20,3656  4 4715 1           CS     FIVE
 0171   REF   8  LAST 1039   20,3657  6 1720 0           AD     JETEM
 0172   REF 246  LAST 1036   20,3660  10 000 0           CCS    A
 0173   REF   1              20,3661  6 3710 1           AD     -CDUT+1
 0174                        20,3662  1 3660 0           TCF    -2
 0175                        20,3663  13 664 1           NOOP
 0176   REF 115  LAST 1037   20,3664  6 4712 1           AD     ONE          SEND NO ZERO TO WTLST
 0177   REF   6  LAST 1034   20,3665  55#725 1           TS     CM/GYMDT     FOR RESTART
 0178   REF  47  LAST 1035   20,3666  0 5140 1           TC     WAITLIST
 0179   REF  34  LAST 1037   E6,1661                     EBANK= ACG
 0180   REF   3  LAST 1035   20,3667   02454 0          2CADR  READGYMB
 0180                        20,3670   32066 0

 0181   REF   1              20,3671  4 3707 0           CS     CM/SWIC1     GAMDIPSW, GYMDIPSW, CM/DSTBY
 0182   REF  17  LAST 1038   20,3672  7 0102 0           MASK   CM/FLAGS     DAPARM, .05GSW, LATSW, ENTRYDSP
 0183   REF   1              20,3673  6 4377 0           AD     CM/SWIC2     SET CM/DSTBY, LATSW
A01831                                                                      DISABLE ENTRY DISPLAY, SINCE DES. GIMB.
A01832                                                                      CALC. (P62.3) GOES TO ENDEXIT.
 0184   REF  18  LAST 1039   20,3674  54 102 0           TS     CM/FLAGS

 0185                        20,3675  3 0007 0           CA     7
 0186   REF   5  LAST  841   20,3676  55#666 1           TS     BETA/180     NECESSARY' NO OVFL CORRECTION
 0188   REF 118  LAST 1039   20,3677  3 4712 1           CA     ONE          INITIALIZE THE TM OF BODY RATES VIA
 0189   REF   1              20,3700  54 305 0           TS     SW/NDX         UPBUFF.

 0190   REF  29  LAST  829   20,3701  0 5261 1           TC     2PHSCHNG     DOES INHINT/RELINT
 0191                        20,3702   40116 0          OCT    40116        SAVE TBASE6
 0192                        20,3703   05024 1          OCT    05024
 0193                        20,3704   13000 0          OCT    13000

 0194   REF  59  LAST 1038   20,3705  0 4574 0           TC     POSTJUMP
```

```
0195   REF   1              20,3706   54326 1            CADR    P62.2
0196                        20,3707   16017 0  CM/SWIC1  OCT     16017
01961  REF   8  LAST 1035      4377            CM/SWIC2  =       TEN
0197                        20,3710   77766 0  -CDUT+1   OCT     77766
0198   REF  23  LAST 1037      1312                       EBANK=  T5LOC
0199   REF   6  LAST  690   20,3711   03143 1  T5IDLER1  2CADR   T5IDLOC
0199                        20,3712   12062 0
```

00012 ' CM/DSTBY, LATSW

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```
P0200  THIS SECTION CALCULATES THE ANGULAR BODY RATES EACH .1 SEC.  THE ANGULAR RATES ARE THOSE ALONG THE BODY AXES
R0202  XB, YB, ZB, AND ARE NORMALLY DESIGNATED  P, Q, R.        REQUIREMENT'  TEMPORARY ERASE. JETEM, JETEM +1

R0204            SINCE RESTARTS ZERO THE JET OUTPUT CHANNELS, NO ATTEMPT IS MADE TO RESTART THE  ENTRY DAPS. THAT IS,
R0206  THE 0.1 SEC DAPS WILL MISS A CYCLE, AND WILL PICK UP AT THE NEXT 0.1 SEC UPDATE. MOST OF THE TIME THE 2 SEC
R0208  ROLL SYSTEM WILL MISS ONLY 0.1 SEC OF CONTROL. HOWEVER IF THE RESTART OCCURS AFTER THE  SECTION TIMETST HAS
R0210  STARTED, THEN THE ROLL SYSTEM WILL MISS ONE CYCLE.
R0211  THIS IS NECESSARY  UNDER THE GROUNDRULE THAT NO JET COMMANDS SHALL BE LESS THAN 14 MS.

 0213  REF  35  LAST 1039   E6,1661                        EBANK= ACG
 0214                       15,2556                        BANK   15
 0215  REF   3  LAST 1036   15,2000                        SETLOC ETRYDAP
02151                       15,2556                        BANK

 0216  REF   3 LAST 1036 TO 1037'     6    66*            COUNT  15/DAPEN

 0218  REF   5  LAST 1034   15,2556  3 1663 0  BODYRATE CA     AMG          THESE ARE 2S COMPL NOS, BUT USE ANYWAY.
 0219  REF   3  LAST  970   15,2557  0 4767 0           TC     SPCOS
 0220  REF   2  LAST  110   15,2560  55∝511 1           TS     COSM

 0221  REF  36  LAST 1041   15,2561  3 1661 1           CA     ACG          C(ACG) = ACG/180
 0222  REF   3  LAST  970   15,2562  0 4770 0           TC     SPSIN        SINO
 0223  REF   2  LAST  110   15,2563  55∝512 1           TS     SINO         SINO = SIN(ACG)

 0224                       15,2564  0 0006 1           EXTEND
 0225  REF   3  LAST 1041   15,2565  7 1511 1           MP     COSM
 0226  REF   2  LAST  110   15,2566  55∝514 1           TS     SINOCOSM     SO CM

 0227  REF  37  LAST 1041   15,2567  3 1661 1           CA     ACG
 0228  REF   4  LAST 1041   15,2570  0 4767 0           TC     SPCOS        COSO
 0229  REF   2  LAST  110   15,2571  55∝513 0           TS     COSO

 0230                       15,2572  0 0006 1           EXTEND
 0231  REF   4  LAST 1041   15,2573  7 1511 1           MP     COSM
 0232  REF   1              15,2574  55∝515 0           TS     COSOCOSM     CO CM

R0233  PITCHDOT'   Q TCDU/180 = IDOT TCDU/160 COSO COSM + MDOT TCDU/180 SINO

 0234  REF   3  LAST 1034   15,2575  4 1677 1           CS     -DELAMG
 0235                       15,2576  0 0006 1           EXTEND
 0236  REF   3  LAST 1041   15,2577  7 1512 1           MP     SINO
 0237  REF   9  LAST 1039   15,2600  53∝721 0           DXCH   JETEM        2 LOCS
 0238  REF   3  LAST 1034   15,2601  4 1676 0           CS     -DELAIG
 0239                       15,2602  0 0006 1           EXTEND
 0240  REF   2  LAST 1041   15,2603  7 1515 0           MP     COSOCOSM
 0241  REF  10  LAST 1041   15,2604  21∝721 0           DAS    JETEM
 0242  REF  11  LAST 1041   15,2605  3 1720 0           CA     JETEM
 0243  REF   3  LAST 1035   15,2606  57∝707 0           XCH    OLDELQ
 0244  REF   1              15,2607  0 2550 0           TC     RATEAVG
 0245  REF   2  LAST  109   15,2610  55∝702 1           TS     QREL         PITCHDOT = Q TCDU/180
```

```
P0246   YAWDOT'   R TCDU/160 = -IDOT TCDU/180 COSM SINO + MDOT TCDU/180 COSO

 0247   REF   4   LAST 1041   15,2611  4 1677 1        CS    -DELAMG
 0248                         15,2612  0 0006 1        EXTEND
 0249   REF   3   LAST 1041   15,2613  7 1513 0        MP    COSO
 0250   REF  12   LAST 1041   15,2614  53«721 0        DXCH  JETEM
 0251   REF   4   LAST 1041   15,2615  3 1676 1        CA    -DELAIG
 0252                         15,2616  0 0006 1        EXTEND
 0253   REF   3   LAST 1041   15,2617  7 1514 1        MP    SINCOSM
 0254   REF  13   LAST 1042   15,2620  21«721 0        DAS   JETEM
 0255   REF  14   LAST 1042   15,2621  3 1720 0        CA    JETEM
 0256   REF   3   LAST 1035   15,2622  57«710 0        XCH   OLDELR
 0257   REF   2   LAST 1041   15,2623  0 2550 0        TC    RATEAVG
 0258   REF   2   LAST  109   15,2624  55«703 0        TS    RREL          YAWDOT = R TCDU/160

R0259    ROLLDOT'   P TCDU/160 = ODOT TCDU/160 + IDOT TCDU/180 SINM

 0260   REF   6   LAST 1041   15,2625  3 1663 0        CA    AMG
 0261   REF   4   LAST 1041   15,2626  0 4770 0        TC    SPSIN
 0262   REF   2   LAST  110   15,2627  55«510 0        TS    SINM

 0263                         15,2630  0 0006 1        EXTEND
 0264   REF   5   LAST 1042   15,2631  7 1676 0        MP    -DELAIG
 0265   REF  15   LAST 1042   15,2632  55«720 1        TS    JETEM
 0266   REF 196   LAST 1035   15,2633  3 4714 1        CA    ZERO
 0267                         15,2634  20 001 1        DDOUBL        ROUND L INTO A
 0268   REF   3   LAST 1034   15,2635  6 1675 1        AD    -DELAOG
 0269   REF  16   LAST 1042   15,2636  6 1720 0        AD    JETEM
 0270   REF 247   LAST 1039   15,2637  4 0000 0        CS    A
 0271   REF  17   LAST 1042   15,2640  55«720 1        TS    JETEM
 0272   REF   3   LAST 1035   15,2641  57«706 1        XCH   OLDELP
 0273   REF   3   LAST 1042   15,2642  0 2550 0        TC    RATEAVG
 0274   REF   2   LAST  109   15,2643  55«701 1        TS    PREL          ROLLDOT = P TCDU/180

A0275                                                   IF GAMDOT ± 0.5 DEG/SEC, THEN GAMDOT =0

 0276   REF   5   LAST 1035   15,2644  11«723 1        CCS   GAMDOT
 0277                         15,2645  0 2647 0        TC    +2
 0278   REF   1                15,2646  0 2671 0        TC    NOGAMDUT
 0279   REF   6   LAST 1038   15,2647  4 1664 0        CS    ROLL/180
 0280   REF   5   LAST 1042   15,2650  0 4770 0        TC    SPSIN
 0281                         15,2651  0 0006 1        EXTEND
 0282   REF   6   LAST 1042   15,2652  7 1723 1        MP    GAMDOT
 0283   REF  18   LAST 1042   15,2653  55«721 0        TS    JETEM +1      -SR GAMDOT
 0284                         15,2654  0 0006 1        EXTEND
 0285   REF   1                15,2655  7 3217 1        MP    SINTRIM       SIN(-20)   (FOR NOMINAL L/D = .3)
 0287   REF   3   LAST 1042   15,2656  27«701 1        ADS   PREL          PREL TCDU/180=(P-SALP SR GAMDOT)TCDU/180

 0286   REF   7   LAST 1042   15,2657  3 1664 1        CA    ROLL/160
 0289   REF   5   LAST 1041   15,2660  0 4767 0        TC    SPCOS
```

```
0290                          15,2661  4 0000 0          COM
0291                          15,2662  0 0006 1          EXTEND
0292  REF   7  LAST 1042      15,2663  7 1723 1          MP      GAMDOT
0293  REF   3  LAST 1041      15,2664  27=702 1          ADS     QREL        QREL TCDU/180=(Q-CR GAMDOT) TCDU/180

0294  REF  19  LAST 1042      15,2665  4 1721 0          CS      JETEM +1    B( ) = -SR GAMDOT
0295                          15,2666  0 0006 1          EXTEND
0296  REF   1                 15,2667  7 3220 0          MP      COSTRIM     COS(-20)   (FOR NOMINAL L/D = .3)
0297  REF   3  LAST 1042      15,2670  27=703 0          ADS     RREL        RREL TCDU/180=(R+CALF SR GAMDOT)TCDU/180

0298  REF  29  LAST 1038      15,2671  3 4677 0  NOGAMDUT CA      BIT12       CMDAPARM = 93D  BIT 12
0299  REF  19  LAST 1039      15,2672  7 0102 0          MASK    CM/FLAGS
0300                          15,2673  0 0006 1          EXTEND
0301  REF  52  LAST 1035      15,2674  1 5213 0  STBYDUMP BZF     TASKOVER    DAP NOT ARMED.

0302  REF  27  LAST 1006      15,2675  3 4672 0          CA      POSMAX      PICK UP AT ATTRATES IN 10 MS OR SO.
0303  REF  25  LAST 1010      15,2676  54 030 0          TS      TIME5

0304                          15,2677  0 0006 1          EXTEND
0305  REF   1                 15,2700  3 2704 0          DCA     ATDOTCAD
0306  REF  24  LAST 1040      15,2701  53=313 0          DXCH    T5LOC
A0307                                                             DOES NOT PROTECT TEMK, SQ IN SPSIN/COS

0308  REF  53  LAST 1043      15,2702  0 5213 1          TC      TASKOVER

0309  REF  38  LAST 1041      E6,1661                    EBANK=  AOG
0310  REF   1                 15,2703   02705 1 ATDOTCAD 2CADR  ATTRATES
0310  REF   1                 15,2704   32066 0
```

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P0311 CALCULATE BODY ATTITUDE RATES AND INTEGRATE TO OBTAIN ATTITUDE ANGLES.

R0312 CB PHIDOT TCDU/180 = (CA PREL + SA RREL) TCDU/180
R0313 BETADOT TCDU/160 = (-SA PREL + CA RREL) TCDU/160
R0314 ALPADOT TCDU = (QREL + SB PHIDOT) TCDU/160

```
 0315  REP  20  LAST 1032   15,2705  22 016 0  ATTRATES LXCH   BANKRUPT        CONTINUE HERE VIA T5
 0316                       15,2706  0 0006 1          EXTEND                  TASK MAY BE SKIPPED AT RESTART.
 0317  REP  16  LAST 1032   15,2707  22 012 1.         QXCH   QRUPT
 0318  REP  11  LAST  356   15,2710  3 0021 1          CA     SR
 0319                       15,2711  6 0000 1          DOUBLE
 0320  REP   2  LAST  111   15,2712  55∝623 0          TS     CM/SAVE
A0321                                                        DOES NOT PROTECT TEMK, SQ IN SPSIN/COS

 0322  REP   4  LAST 1043   15,2713  3 1702 0          CA     QREL
 0323  REP   5  LAST 1038   15,2714  6 1665 0          AD     ALPA/160
 0324  REP   1              15,2715  0 2542 0          TC     ANGOVCOR
 0325  REP   6  LAST 1044   15,2716  55∝665 1          TS     ALPA/180
 0326  REP   6  LAST 1042   15,2717  0 4767 0          TC     SPCOS
 0327  REP   2  LAST  110   15,2720  55∝506 1          TS     CALPA           CALPA
 0328  REP   2  LAST  109   15,2721  55∝705 0          TS     PHIDOT

 0329                       15,2722  0 0006 1          EXTEND
 0330  REP   4  LAST 1042   15,2723  7 1701 1          MP     PREL
 0331  REP   3  LAST 1044   15,2724  57∝705 1          XCH    PHIDOT          CA PREL
 0332                       15,2725  0 0006 1          EXTEND
 0333  REP   4  LAST 1043   15,2726  7 1703 0          MP     RREL            CA RREL
 0334  REP   2  LAST  109   15,2727  55∝704 1          TS     BETADOT

 0335  REP   7  LAST 1044   15,2730  3 1665 0          CA     ALPA/180
 0336  REP   6  LAST 1042   15,2731  0 4770 0          TC     SPSIN
 0337  REP   2  LAST  110   15,2732  55∝507 0          TS     SALPA           SIN(ALPA)

 0338                       15,2733  0 0006 1          EXTEND
 0339  REP   5  LAST 1044   15,2734  7 1703 0          MP     RREL            SA RREL
 0340  REP   4  LAST 1044   15,2735  27∝705 0          ADS    PHIDOT          CB PHIDOT, SAVED.

 0341  REP   3  LAST 1044   15,2736  4 1507 0          CS     SALPA
 0342                       15,2737  0 0006 1          EXTEND
 0343  REP   5  LAST 1044   15,2740  7 1701 1          MP     PREL
 0344  REP   3  LAST 1044   15,2741  27∝704 1          ADS    BETADOT         SAVE BETADOT TCDU/160
 0345  REP   6  LAST 1039   15,2742  27∝666 1          ADS    BETA/160        BETA DONE.

 0346  REP   7  LAST 1044   15,2743  0 4770 0          TC     SPSIN
 0347                       15,2744  0 0006 1          EXTEND
 0348  REP   5  LAST 1044   15,2745  7 1705 0          MP     PHIDOT          NEGLECT CB IN  CB PHIDOT
 0349  REP   8  LAST 1044   15,2746  6 1665 0          AD     ALPA/180
 0350  REP   2  LAST 1044   15,2747  0 2542 0          TC     ANGOVCOR
 0351  REP   9  LAST 1044   15,2750  55∝665 1          TS     ALPA/180        ALPA DONE.
```

```
0352                          15,2751  4 0000 0        COM
0353  REF   4  LAST 1038     15,2752  6 1603 0        AD    ALFACOM
0354  REF   3  LAST 1044     15,2753  0 2542 0        TC    ANGOVCOR      JUST IN CASE ...
0355  REF   7  LAST  994     15,2754  55=477 0        TS    AK1
0356  REF   2  LAST  111     15,2755  55=572 1        TS    QAXERR        FOR PITCH FDAI   AND EDIT.

0357  REF   6  LAST 1044     15,2756  3 1705 1        CA    PHIDOT        PHIDOT TCDU/180, NEGLECTING CB
0358  REF   8  LAST 1042     15,2757  6 1864 1        AD    ROLL/180
0359  REF   4  LAST 1045     15,2760  0 2542 0        TC    ANGOVCOR
0360  REF   3  LAST  173     15,2761  55=714 0        TS    ROLLTM        ROLL/180 FOR TM.
0361  REF   9  LAST 1045     15,2782  55=684 0        TS    ROLL/180      ROLL DONE.

R0362       START YAW AUTOPILOT HERE .  RATE DAMPING WITH ENFORCED COORDINATED ROLL MANEUVER.

0364  REF  31  LAST  982     15,2783  3 4710 0        CA    BIT3          .05GSW =10 2D BIT3      SW=0, LESS .05G
0365  REF  20  LAST 1043     15,2784  7 0102 0        MASK  CM/FLAGS      SWITCH =1, GREATER THAN .05 G
0366                          15,2765  0 0008 1        EXTEND
0367  REF   1                 15,2786  1 3054 1        BZF   EXDAP       IF G LESS THAN .05
0368  REF 117  LAST 1039     15,2767  4 4712 0        CS    ONE         IF G GEQ  THAN .05
0369  REF   5  LAST  748     15,2770  55=700 0        TS    CMDAPMOD      SAVE -1 FOR USE IN CM/RCS

0370  REF   8  LAST 1045     15,2771  55=477 0        TS    AK1           TO ZERO PITCH AND YAW FDAI NEEDLES
0371  REF   8  LAST  994     15,2772  55=500 1        TS    AK2           IN ATM.  (MODE =-1)

03713 REF   6  LAST 1044     15,2773  4 1701 1        CS    PREL          YAW ERROR = RREL - PREL TAN(ALFA)
0372                          15,2774  0 0006 1        EXTEND
0373  REF   2  LAST 1042     15,2775  7 3217 1        MP    SINTRIM       LET SIN(-20) BE APPROX FOR TAN(-20)
0374  REF   6  LAST 1044     15,2778  8 1703 1        AD    RREL
0375  REF   1                 15,2777  0 3044 1        TC    2D/SDZ        GO TEST DZ. GET TAG' +0 IF IN DZ
0376  REF 248  LAST 1042     15,3000  50 000 1        INDEX A             +/- 1 IF NOT
0377  REF   1                 15,3001  3 3222 0        CAF   YJETCODE

0378  REF  20  LAST 1043     15,3002  55=720 1        TS    JETEM

R0379       START PITCH AUTOPILOT HERE.  RATE DAMPING ONLY.

0380  REF   5  LAST 1044     15,3003  3 1702 0        CA    QREL
0381  REF   2  LAST 1045     15,3004  0 3044 1        TC    2D/SDZ
0382  REF 249  LAST 1045     15,3005  50 000 1 EXDAPIN INDEX A            COME HERE FROM EX ATM DAP
0383  REF   1                 15,3006  3 3225 1        CAF   P/RJCODE
0384  REF  21  LAST 1045     15,3007  27=720 1        ADS   JETEM         COMBINE ALL NEW BITS.

0385                          15,3010  0 0006 1        EXTEND              DOES NOT REQUIRE SAVING OLD CODES.
0386  REF   2  LAST 1036     15,3011  01 005 0        WRITE PYJETS        SET PYCHAN TO DESIRED BIT CONFIG.

0387  REF   4  LAST 1037     15,3012  11=711 0        CCS   JETAG
0388  REF   1                 15,3013  0 3238 0        TC    CM/RCS
0389  REF   1                 15,3014  0 3718 1        TC    CM/FDAI
0390  REF   1                 15,3015  0 3723 1        TC    CM/FDAIR -1   (JETAG=-1 EQUIVALENT TO CMDAPMOD=+1)
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P0391 DEAD ZONE LOGIC USED BY ENTRY DIGITAL AUTOPILOTS.

```
0392  REP 250  LAST 1045   15,3016  10 000 0  3DDZ      CCS   A          YAWLIM=1.0-3/180=16384-273=16111
0393  REP   1              15,3017  6 3215 1             AD    YAWLIM
0394  REP   1              15,3020  1 3050 0             TCF   DZCOM
0395  REP   2  LAST 1046   15,3021  6 3215 1             AD    YAWLIM
0396  REP   1              15,3022  1 3051 1             TCF   DZNOCOM

A0397                                                        BIASED DZ FOR EXT ATM DAP.
0398  REP   1              15,3023  55#624 1 BIASEDZ     TS    JETEM2     SAVE RATE/180. ERROR/180 IS IN L.
0399  REP 251  LAST 1046   15,3024  10 000 0             CCS   A          START ERROR DZ.
0400  REP   1              15,3025  4 3214 1             CS    CM/BIAS    = .6/180
0401                       15,3026  1 3030 0             TCF   +2
0402  REP   2  LAST 1046   15,3027  3 3214 0             CA    CM/BIAS
0403  REP 133  LAST 1036   15,3030  6 0001 0             AD    L          BIAS THE ERROR.
0404  REP 207  LAST 1036   15,3031  22 002 0             LXCH  Q          SAVE CALLERS RETURN ADDRESS.
0405  REP   1              15,3032  0 3016 0             TC    3DDZ       GO GENERATE THE ERROR BIT.
0406  REP 134  LAST 1046   15,3033  52 002 1             DXCH  L          BIT TO L, RESTORE CALLERS Q.
0407  REP   2  LAST 1046   15,3034  11#624 1 4D/SDZ      CCS   JETEM2     CAME HERE IN EXT ATM. C(L) = ERROR BIT
0408  REP   1              15,3035  6 3212 0             AD    4D/SLIM    IF RATE GEQ 4D/S, SET L=0 AND TAKE
0409                       15,3036  1 3040 1             TCF   +2         JET BITS ACCORDING TO SGN OF RATE.
0410  REP   2  LAST 1046   15,3037  6 3212 0             AD    4D/SLIM
0411  REP 252  LAST 1046   15,3040  54 000 0             TS    A
0412                       15,3041  1 3043 1             TCF   +2         RATE OK. CONTINUE
0413                       15,3042  22 007 0             ZL               RATE GEQ 4 D/S. OVER RIDE ERROR BIT
0414  REP   3  LAST 1046   15,3043  57#624 0             XCH   JETEM2     AND CONTINUE TO GET SIGN.

0415  REP 253  LAST 1046   15,3044  10 000 0 2D/SDZ      CCS   A          COME HERE TO TEST IF A WITHIN 2DEG/S DZ
0416  REP   1              15,3045  6 3213 1             AD    YDOTLIM    1.0 - YDOT DZ          ( OR PDOT)
0417                       15,3046  1 3051 1             TCF   +3
0418  REP   2  LAST 1046   15,3047  6 3213 1             AD    YDOTLIM    YDOT DZ = 2 DEG/SEC
0419                       15,3050  4 0000 0 DZCOM       COM
0420  REP  22  LAST 1045   15,3051  55#721 0 DZNOCOM     TS    JETEM +1   GENERATE TAG, SET C(A)= -+1 OUTSIDE DZ
0421  REP 197  LAST 1042   15,3052  3 4714 1             CA    ZERO       SET C(A) = +0 INSIDE
0422  REP 208  LAST 1046   15,3053  0 0002 0             TC    Q
```

```
P0423            EXTRA ATMOSPHERIC DIGITAL AUTOPILOT

R0424            1.    IF ABS(CALP) -C(45) POS, USE                  IF CALPA POS, CMDAPMOD= +0
R0426              BETA'   YAW ERROR = SGN(CALP) (BETACOM -BETA)      IF CALPA NEG, CMDAPMOD =-0
R0428                            RATE = BETADOT                      IF CMDAPMOD =-0, RATE =  RREL
R0430                         R-AXIS = CONTROL

R0431              ROLL'   ROLL ERROR = SGN(CALP) (ROLLC - ROLL)     IF CMDAPMOD = -0, RATE DAMP ONLY.
R0433                            RATE = PREL
R0434                         P-AXIS = CONTROL

R0435            2.    IF C(45) GEQ CALPA GEQ -C(45), USE            CMDAPMOD = +1
R0437              BETA'   ROLL ERROR = SGN(-SALP) (BETACOM -BETA)
R0438                            RATE = BETADOT
R0439                         P-AXIS = CONTROL

R0440              ROLL'   YAW ERROR = SGN(SALP) (ROLLC -ROLL)       RATE DAMP ONLY.
R0442                            RATE = RREL
R0443                         R-AXIS = CONTROL

R0444            3.  FOR ALL CASES , USE
R0445              ALPA'   PITCH ERROR = (ALPACOM - ALPA)
R0446                            RATE = QREL
R0447                         Q-AXIS = CONTROL

R0448

 0449  REP   6  LAST 1045   15,3054  55#700 0  EXDAP   TS    CMDAPMOD   -   +0 FOR NOW
 0450  REP   7  LAST 1044   15,3055  4 1666 1          CS    BETA/180
 0451  REP   2  LAST  110   15,3056  6 1604 1          AD    BETACOM
 0452  REP  23  LAST 1046   15,3057  55#721 0          TS    JETEM +1    PRESERVE THIS FOR A WHILE.

 0453  REP   3  LAST 1044   15,3060  11#506 1          CCS   CALPA
 0454  REP   1              15,3061  6 3216 1          AD    C45LIM      =1.0-COS(45)
 0455                       15,3062  1 3064 1          TCF   +2
 0456  REP   2  LAST 1047   15,3063  6 3216 1          AD    C45LIM
 0457  REP 254  LAST 1046   15,3064  54 000 0          TS    A
 0458  REP   1              15,3065  1 3146 0          TCF   EXDAP2      HERE IF ABS(CALPA) L COS(45)

 04582 REP   4  LAST 1047   15,3066  11#506 1          CCS   CALPA       YCALPAY 5 0.707
 04583                      15,3067  1 3070 1          TCF   +1          CONTINUE IF POS
```

```
0459   REF   4  LAST 1037   15,3070  11=727 0        CCS   P63FLAG    VALID VALUES ARE'  -1, +1, +0.
0460   REF   1               15,3071  0 3104 1        TC    EXDAP4
0461                         15,3072  0 3074 1        TC    +2
0462   REF   2  LAST 1047   15,3073  0 3104 1        TC    EXDAP4
0463   REF  89  LAST 1035   15,3074  0 5301 0        TC    PHASCHNG   SINGLE PASS THROUGH HERE.
0464                         15,3075   40334 1        OCT   40334
0465   REF 118  LAST 1045   15,3076  4 4712 0        CS    ONE
0466   REF   5  LAST 1047   15,3077  55=727 0        TS    P63FLAG    SET FLAG TO ASSURE SINGLE PASS.
```

L CM ENTRY DIGITAL AUTOPILOT USER=S PAGE NO. 15 E6 S3

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0467  REF   1                15,3100  3 3211 0          CA     NSEC
0468  REF  48  LAST 1039     15,3101  0 5140 1          TC     WAITLIST
0469  REF  39  LAST 1043     E6,1881                    EBANK= ACC
0470  REF   2  LAST  209     15,3102    02374 0         2CADR  WAKEP62        CALL TO TERMINATE P62 IN N SEC.
0470                          15,3103    54086 0
A0471                                                                        65 DEG/ 3DEG/SEC = 21 SEC NOMINAL
A0472                                                                        TRANSIT TIME FROM ALPA=45 TO ALPA TRIM.

0473  REF   5  LAST 1045     15,3104  11=711 0  EXDAP4   CCS    JETAG         ROLLJET INTERFACE TEST BETWEEN .1 SEC
0474  REF   1                15,3105  1 3113 0          TCF    EXDAP3        DAP AND THE 2 SEC CM/RCS DAP
0475  REF   2  LAST 1048     15,3108  1 3113 0          TCF    EXDAP3
0476  REF 198  LAST 1046     15,3107  3 4714 1          CA     ZERO
0477                          15,3110  0 0006 1          EXTEND                TURN OFF ROLL JETS IF ON AND WAIT
0478  REF   2  LAST 1036     15,3111  01 008 0          WRITE  ROLLJETS       UNTIL START OF 2 SEC CM/RCS CYCLE
0479  REF   6  LAST 1048     15,3112  55=711 0          TS     JETAG          RESTORE PROPER VALUE +0

A0480                                                                                ROLL FDAI WILL BE IN ERROR UNTIL NEXT CM/RCS CALL.
0481  REF   5  LAST 1047     15,3113  11=506 1  EXDAP3   CCS    CALFA          HERE IF ABS(CALFA) GEQ COS(45)
0482  REF  24  LAST 1047     15,3114  3 1721 1          CA     JETEM +1
0483  REF   1                15,3115  1 3121 1          TCF    EXDAP1
0484  REF 199  LAST 1048     15,3116  4 4714 0          CS     ZERO
0485  REF   7  LAST 1047     15,3117  55=700 0          TS     CMDAPMOD       FOR CM/RCS
0488  REF  25  LAST 1048     15,3120  4 1721 0          CS     JETEM +1
0487  REF   1                15,3121  55=573 0  EXDAP1   TS     RAXERR         FOR YAW FDAI
0488  REF   9  LAST 1045     15,3122  55=500 1          TS     AK2            WANT RAXERR FOR TM.
0489  REF 135  LAST 1046     15,3123  54 001 1          TS     L
0490  REF   8  LAST 1048     15,3124  11=700 0          CCS    CMDAPMOD       COORDINATE BETA CONTROL.
0491                          15,3125  0 3130 0          TC     +3             C(CMDAPMOD) CAN BE +1, +0, OR -0.
0492  REF 119  LAST 1047     15,3128  3 4712 1          CA     ONE            USE BETADOT TO COORD IN MODE +0
0493  REF 255  LAST 1047     15,3127  50 000 1          INDEX  A              OTHERWISE USE RREL.
0494  REF   7  LAST 1045     15,3130  3 1703 1          CA     RREL
0495  REF   1                15,3131  0 3023 0          TC     BIASEDZ        GO TEST DZ. +0 IF IN DZ, +-1 OTHERWISE
A0496                                                                        IF GEQ 4D/S, SET ERROR BIT IN L =0)
0497                          15,3132  0 0008 1          EXTEND
0498  REF  12  LAST  988     15,3133  04 001 1          ROR    LCHAN          L HAS BETA BIT
0499  REF 256  LAST 1048     15,3134  50 000 1          INDEX  A
0500  REF   2  LAST 1045     15,3135  3 3222 0          CAF    YJETCODE
0501  REF  26  LAST 1048     15,3136  55=720 1          TS     JETEM

0502  REF   3  LAST 1045     15,3137  3 1572 0          CA     QAXERR         ALPA ERROR.
0503  REF 136  LAST 1048     15,3140  54 001 1          TS     L
0504  REF   6  LAST 1045     15,3141  3 1702 0          CA     QREL           FOR ALPADOT USE QREL
0505  REF   2  LAST 1048     15,3142  0 3023 0          TC     BIASEDZ
0506                          15,3143  0 0008 1          EXTEND
0507  REF  13  LAST 1048     15,3144  04 001 1          ROR    LCHAN
0508  REF   1                15,3145  1 3005 0          TCF    EXDAPIN        CONTINUE ON IN DAP

0509  REF   9  LAST 1048     15,3146  25=700 1  EXDAP2   INCR   CMDAPMOD       SET CMDAPMOD TO +1

0510  REF 120  LAST 1048     15,3147  4 4712 0          CS     ONE            INDICATE CHANGE FROM .1 SEC UPDATE TO
```

```
 0511  REF   7  LAST 1048   15,3150  55«711 0          TS    JETAG     TO 2 SEC FOR ROLL JETS.( IF CMDAPMOD
A0512                                                                  =0 AND JETAG =-1, QUENCHES JETS IF ON)

 0513  REF   6  LAST 1047   15,3151  11«727 0          CCS   P63FLAG   IF FLAG WAS +1,. SET =0.
 0514  REF   7  LAST 1049   15,3152  55«727 0          TS    P63FLAG
 0515                       15,3153  13 154 0          NOOP

 0516  REF   4  LAST 1044   15,3154  11«507 0          CCS   SALFA     BETA CONTROL WITH P JETS
 0517  REF  27  LAST 1048   15,3155  4 1721 0          CS    JETEM +1
 0518                       15,3156  1 3160 1          TCF   +2
 0519  REF  28  LAST 1049   15,3157  3 1721 1          CA    JETEM +1
 0520  REF   4  LAST 1037   15,3160  55«713 1          TS    PAXERR1   TEMP SAVE.  ERROR/160
 0521                       15,3161  0 0006 1          EXTEND
 0522  REF   5  LAST 1038   15,3162  7 4675 0          MP    HALF      CM/FDAI EXPECTS ERROR/360.
 0523  REF   5  LAST 1049   15,3163  57«713 0          XCH   PAXERR1   ERROR/360 FOR FDAI, GET ERROR/180.
 0524  REF 137  LAST 1048   15,3164  54 001 1          TS    L
 0525  REF   5  LAST 1049   15,3165  11«507 0          CCS   SALFA
 0526  REF   4  LAST 1044   15,3166  4 1704 1          CS    BETADOT   USE BETADOT TO COORD IN MODE +1
 0527                       15,3167  0 3171 0          TC    +2
 0528  REF   5  LAST 1049   15,3170  3 1704 0          CA    BETADOT
 0529  REF   3  LAST 1048   15,3171  0 3023 0          TC    BIASEDZ
 0530                       15,3172  0 0006 1          EXTEND
 0531  REF  14  LAST 1048   15,3173  04 001 1          ROR   LCHAN
 0532  REF 257  LAST 1048   15,3174  50 000 1          INDEX A
 0533  REF   2  LAST 1045   15,3175  3 3225 1          CAF   P/RJCODE  GET ROLL CODE
 0534                       15,3176  0 0006 1          EXTEND          ROLL CONTROL WITH YAW JETS.
 0535  REF   3  LAST 1048   15,3177  01 006 0          WRITE ROLLJETS  WE,LL SKIP REGULAR ROLL SYST

 0536  REF   3  LAST 1038   15,3200  3 1717 1          CA    ROLLHOLD  ROLL/180 AT CM/DAPON TIME.
 0537                       15,3201  0 0006 1          EXTEND
 0538  REF  10  LAST 1045   15,3202  21«664 0          MSU   ROLL/180  1,S COMPL, BUT SO WHATS A BIT.W
 0539  REF 138  LAST 1049   15,3203  54 001 1          TS    L         FORCE A LIMIT CYCLE IN YAW RATE.
 0540  REF   6  LAST 1049   15,3204  11«507 0          CCS   SALFA
 0541  REF 139  LAST 1049   15,3205  3 0001 0          CA    L         TO REMOVE ITS BIASING EFFECT ON M DOT.
 0542  REF   2  LAST 1048   15,3206  0 3121 0          TC    EXDAP1
 0543  REF 140  LAST 1049   15,3207  4 0001 1          CS    L
 0544  REF   3  LAST 1049   15,3210  0 3121 0          TC    EXDAP1

 0545                       15,3211  04064 1  NSEC     DEC   2100      65 DEG/ 3 DEG/SEC
A0546                                                                  IF NSEC IS CHANGED, REMEMBER TO CHANGE 4.33SPOT.
 0547                       15,3212  37734 0  4D/SLIM  DEC   16348     1.0 -4/180 D/S = 4/1600 EXP 14
 0548                       15,3213  37756 1  YDOTLIM  DEC   16366     =1.0 - YDOT DZ= 16364 -16
A0549                                                                  YDOT DZ = YDOT TCDU/160 = 2/1600 EXP 14

 0550                       15,3214  00067 0  CM/BIAS  DEC   55        =.6/180 B14  = 55
 0551                       15,3215  37267 0  YAWLIM   DEC   16055     YAWLIM=1.0-3.6/180=16364-329=16055
 0552                       15,3216  11277 0  C45LIM   DEC   .29289    =1.0-COS(45)
R0553
 05531                      15,3217  65033 1  SINTRIM  DEC   -.34202   SIN(-20)      (FOR NOMINAL L/D = .3)
 05532                      15,3220  36044 1  COSTRIM  DEC    .93969   COS(-20)      (FOR NOMINAL L/D = .3)
```

R05534 TO MAKE DAP INSENSITIVE TO PITCH ERRORS DUE TO ACCUMULATED NAV ERRORS,USE NOMINAL VALUE (-20 DEG) FOR TRIM ALFA
R05536 USED DURING ATMOSPHERIC COORDINATION. OUTSIDE ATMOSPHERE, NAV ERRORS WILL BE SLIGHT, BUT ALFA CAN DIFFER GREATLY
R05538 FROM TRIM, SO USE ON-BOARD ESTIMATES.
A0554

JET CODE TABLES FOLLOW

```
0555                15,3221  00120 1          OCTAL  00120     POS Y
0556                15,3222  00000 1  YJETCODE OCTAL  00000     RCS JET BITS
0557                15,3223  00240 1          OCTAL  00240     NEG Y
0558                15,3224  00005 1          OCTAL  00005     POS R JET BITS    ALSO POS P JET BITS
0559                15,3225  00000 1  P/RJCODE OCTAL  00000
0560                15,3226  00012 1          OCTAL  00012     NEG R             ALSO NEG P
```

```
P0561  RCS        THIS SECTION IS ENTERED EACH 2 SEC BY WAITLIST CALL FOLLOWING A DELAY OF 1.2 SEC AFTER PIPUP.
R0563  THE TASK SETJTAG  SETS A FLAG IN  JETAG  TO SIGNIFY THAT ROLL UPDATE IS DUE.  IN ROUGHLY 5 CS  BPDYRATE WILL BE
R0565  EXECUTED AND JETAG WILL CAUSE  CM/RCS  TO ACT ON ROLLC IMMEDIATELY THEREAFTER.  THE
R0567  TASK SAVES THE CALL TIME SO THAT CM/RCS CAN DETERMINE HOW MUCH OF THE 2 SEC INTERVAL REMAINS BEFORE THE
R0569  NEXT UPDATE.

 0570  REF  15  LAST 1039   15,3227  4 0025 1  SETJTAG  CS    TIME1          SAVE NOMINAL UPDATE TIME FOR SYNCH
 0571  REF   2  LAST  109   15,3230  55=712 0           TS    TUSED
A0572                                                                      THE 5 CS APPEARS IN TIMETST.
 0573  REF 121  LAST 1048   15,3231  3 4712 1           CA    ONE            RATHER THAN INCR, FOR SAFETY
 0574  REF   8  LAST 1049   15,3232  55=711 0           TS    JETAG          SET JETAG=1 TO CAUSE CM/RCS TO BE
 0575  REF  90  LAST 1047   15,3233  0 5301 0           TC    PHASCHNG
 0576                       15,3234   00001 0           OCT   00001

 0577  REF  54  LAST 1043   15,3235  0 5213 1           TC    TASKOVER       EXECUTED AFTER NEXT BODYRATE UPDATE

R0576  PREDICTIVE ROLL SYSTEM    ENTRY STEERING PROVIDES ROLL COMMAND IN LOC ROLLC. THE FOLLOWING CALCULATES THE
R0560  TRAJECTORY TO THE ORIGIN IN PHASE PLANE (X,V). PROGRAM ENTERS JET ON AND OFF CALLS INTO WTLST TO PRODUCE
R0562  THE DESIRED TRAJECTORY. ONLY THOSE CALLS WHICH CAN BE EXECUTED WITHIN THE INTERVAL T (2 SEC) ARE ENTERED IN
R0584  WTLST, THE REMAINDER ARE RECONSIDERED AT NEXT UPDATE.

 0565  REF   4  LAST  166        4674              HALFPR  EQUALS NEG1/2 +1

                                                                           CLEAR JETAG BEFORE TIMETST.  SET TO +0 TO SHOW
A0566                                                                      ROLL DAP CALLED.  IN EVENT OF RESTART, BODYRATE
A0567                                                                      MAY MISS A CYCLE.  CM/RCS WILL MISS A CYCLE ONLY
A0566                                                                      IF A RESTART OCCURS AFTER TIMETST COMMENCES..
A0569

 0590  REF 122  LAST 1051   15,3236  4 4712 0  CM/RCS  CS    ONE
 0591  REF   2  LAST  110   15,3237  55=617 1           TS    JNDX           SET NDX FOR POS ROLL, AND CHANGE LATER

 0592  REF   1              15,3240  4 4726 1           CS    2T/TCDU        ROLLDOT = DELACG + DELAIG SINM =DELR
 0593                       15,3241  0 0006 1           EXTEND
 0594  REF   7  LAST 1045   15,3242  7 1701 1           MP    PREL           DELR/160 = RDOT TCDU/160 = RDOT/1600
 0595  REF 141  LAST 1049   15,3243  6 0001 0           AD    L              -2 RDOT T/160 IN L
 0596  REF   2  LAST  110   15,3244  55=613 0           TS    -VT/160        SAVE -2VT/160 HERE

 0597  REF  11  LAST 1049   15,3245  4 1664 0           CS    ROLL/160
 0598  REF  12  LAST 1044   15,3246  54 021 0           TS    SR             SAVE (-R/160) /2

 0599  REF  21  LAST 1045   15,3247  4 0102 0           CS    CM/FLAGS
 0600  REF  38  LAST 1027   15,3250  7 4707 1           MASK  BIT4           LATSW = 101D BIT4
 0601                       15,3251  0 0006 1           EXTEND               ROLL OVER TOP S
 0602  REF   1              15,3252  1 3260 1           BZF   GETLCX         NO, TAKE SHORTEST PATH
 0603  REF  22  LAST 1051   15,3253  26 102 0           ADS   CM/FLAGS       YES, ENFORCE ROLL OVER TOP.. (BIT =0)
 0604  REF  13  LAST 1036   15,3254  3 1715 0           CA    ROLLC          (ROLLC/160) /2
 0605  REF  13  LAST 1051   15,3255  6 0021 1           AD    SR             -(R/180) /2
 0606  REF   2  LAST  110   15,3256  57=614 0           XCH   LCX/360        DIFFERENT X REQD HERE. DISCONT AT 180.
 0607  REF   1              15,3257  1 3320 1           TCF   COMPAT         POSSIBLE OVFL ABOVE.
```

```
0608  REF   3  LAST 1039   15,3260  3 4675 1  GETLCX   CA      POS1/2        FORM RCOM/360
0609                       15,3261  6 0000 1           DOUBLE
0610  REF  14  LAST 1051   15,3262  6 1715 0           AD      ROLLC
0611  REF   3  LAST 1051   15,3263  57∝614 0           XCH     LCX/360       IGNORE POSSIBLE OVFL.

0612  REF  14  LAST 1051   15,3264  3 0021 1           CA      SR            FORM -R/360
0613  REF   5  LAST 1051   15,3265  6 4673 1           AD      NEG1/2
0614  REF   6  LAST 1052   15,3266  6 4673 1           AD      NEG1/2        IGNORE OVFL
0615  REF   4  LAST 1052   15,3267  57∝614 0           XCH     LCX/360       -R/360
0616  REF   5  LAST 1052   15,3270  27∝614 1           ADS     LCX/360       LCX/360 = RCOM/360 -R/360  RANGE (-1,1)

R0617  DOES SGN(-VT) (VT/160) (VT/160) (160/(4 A1 TT COSALFA)) + X/360 + SGN(X) / 2          OVFL  *

0619  REF   3  LAST 1051   15,3271  11∝613 0           CCS     -VT/160       TAKE SHORTEST ANGULAR PATH
0620  REF 123  LAST 1051   15,3272  6 4712 1           AD      ONE           (BASED ON SINGLE JET ACCELERATION)
0621                       15,3273  1 3275 0           TCF     +2
0622  REF 124  LAST 1052   15,3274  6 4712 1           AD      ONE
0623                       15,3275  0 0006 1           EXTEND
0624  REF   4  LAST 1052   15,3276  7 1613 0           MP      -VT/160       C(-VT/160) = -2 VT/160
0625                       15,3277  0 0006 1           EXTEND
0626  REF   1              15,3300  7 3767 0           MP      1/16A1        = 160/(16 A1 TT )
0627                       15,3301  0 0006 1           EXTEND
0628  REF   6  LAST 1046   15,3302  11∝506 1           DV      CALFA
0629  REF 142  LAST 1051   15,3303  54 001 1           TS      L
0630  REF   6  LAST 1052   15,3304  11∝614 1           CCS     LCX/360
0631  REF   4  LAST 1052   15,3305  3 4675 1           CAF     POS1/2
0632                       15,3306  1 3310 1           TCF     +2
0633  REF   5  LAST 1052   15,3307  4 4675 0           CS      POS1/2
0634  REF   7  LAST 1052   15,3310  6 1614 0           AD      LCX/360       IS LCX/360 LESS THAN 160 DEG  $
0635  REF 143  LAST 1052   15,3311  6 0001 0           AD      L
0636  REF 144  LAST 1052   15,3312  54 001 1           TS      L
0637  REF   2  LAST 1051   15,3313  1 3320 1           TCF     COMPAT        YES, GO ON.
0638  REF 256  LAST 1049   15,3314  50 000 1  TRTAGXPI INDEX   A             NO, SHIFT X BY - SGN(X) 2 PI
0639  REF   1              15,3315  4 4674 1           CS      HALFPR        +A YIELDS -1/2
0640                       15,3316  6 0000 1           DOUBLE
0641  REF   6  LAST 1052   15,3317  27∝614 1           ADS     LCX/360

0642  REF   9  LAST 1052   15,3320  3 1614 0  COMPAT   CA      LCX/360       CORRECT FOR ASSUMED COORD TURN.
0643                       15,3321  0 0006 1           EXTEND
0644  REF   7  LAST 1052   15,3322  7 1506 1           MP      CALFA         COS ALFA
0645  REF  10  LAST 1052   15,3323  55∝614 1           TS      LCX/360       SCALED LCX OK HERE.

0646  REF  10  LAST 1046   15,3324  11∝700 0           CCS     CMDAPMOD      FOUR POSSIBILITIES HERE
0647  REF   1              15,3325  0 3714 0           TC      DZZCALL1      EXIT, SETTING JETAG=0.(C(A)=0)
A0646                                                                       ALL 3 AXES ALREADY DONE.
0649                       15,3326  0 3327 1           TC      +1            G LESS THAN .05. CA POS. CONTINUE
0650  REF  11  LAST 1052   15,3327  3 1614 0           CA      LCX/360       G GEQ .05. CONTINUE IN CM/RCS
0651  REF  12  LAST 1052   15,3330  55∝614 1           TS      LCX/360       CMDAPMOD=-0. DAMPING ONLY. SET LCX=0
0652  REF   6  LAST 1049   15,3331  55∝713 1           TS      PAXERR1       SAVE LCX FOR FDAI AND EDIT.(  /360)
```

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0653  REF   5  LAST 1052   15,3332  3 1613 1          CA      -VT/180        GET - 2 VT/180
0654  REF  15  LAST 1052   15,3333  54 021 0          TS      SR
0655  REF  16  LAST 1053   15,3334  3 0021 1          CA      SR             GET -VT/180, LEAVE -VT/360 IN SR FOR DZ
0656  REF   1               15,3335  55=570 0          TS      -VT/180E                                DIAGNOSTIC ****
0657  REF   6  LAST 1053   15,3336  57=613 1          XCH     -VT/180        NOW CONTENTS OF -VT/180 AS LABELED
0658                        15,3337  0 0006 1          EXTEND
0659  REF   7  LAST 1053   15,3340  7 1613 0          MP      -VT/180        B(A) = -2VT/180
0660                        15,3341  0 0006 1          EXTEND
0661  REF   1               15,3342  7 3767 0          MP      160/8ATT
0662  REF   2  LAST  110    15,3343  55=616 0          TS      VSQ/4API

R0663   IS SGN(VT) ( (160/4A1 TT) VT/160 VT/160 - .5 BUFLIM/360 ) -X/360     - .5 BUFLIM/360   POS ?

0665                        15,3344  6 0000 1  WHICHALF DOUBLE                 FOR SECOND BURN, A1
0666                        15,3345  4 0000 0          COM
0667  REF   1               15,3346  6 3773 1          AD      BUFLIM         =BUFLIM/(2 360)
0668  REF 145  LAST 1052    15,3347  54 001 1          TS      L
0669  REF   8  LAST 1053   15,3350  11=613 0          CCS     -VT/160
0670  REF 146  LAST 1053   15,3351  4 0001 1          CS      L
0671                        15,3352  1 3354 1          TCF     +2
0672  REF 147  LAST 1053   15,3353  3 0001 0          CA      L
0673  REF  13  LAST 1052   15,3354  6 1614 0          AD      LCX/360
0674  REF   2  LAST 1053   15,3355  6 3773 1          AD      BUFLIM
0675                        15,3356  0 0006 1          EXTEND
0676  REF   1               15,3357  6 3374 1          BZMF    REFLECT        POINT (X,V) IN LHP.

R0677   IS SGN(VT) ( (160/4A1 TT) VT/160 VT/160 - .5 BUFLIM/360 ) -X/360     + .5 BUFLIM/360   NEG ?

0679                        15,3360  4 0000 0          COM
0680  REF   3  LAST 1053   15,3361  6 3773 1          AD      BUFLIM
0681  REF   4  LAST 1053   15,3362  6 3773 1          AD      BUFLIM
0682                        15,3363  0 0006 1          EXTEND
0683  REF   1               15,3364  6 3403 0          BZMF    DZ1            POINT (X,V) IN RHP.

R0684   IS POINT WITHIN VELOCITY DZ ?

0685  REF   1               15,3365  4 3766 1          CS      VSQMIN         IS VSQ/4API - (VSQ/4API) MIN  NEG ?
0686  REF   3  LAST 1053   15,3366  6 1616 1          AD      VSQ/4API
0687                        15,3367  0 0006 1          EXTEND
0688  REF   1               15,3370  6 3676 0          BZMF    DZCALL         YES.

R0689           POINT IS IN BUFFER ZONE. THRUST TO X AXIS.

0690  REF   3  LAST 1051   15,3371  4 1617 1          CS      JNDX
0691  REF   2  LAST  111    15,3372  55=620 0          TS      JNDX1
0692  REF   1               15,3373  0 3456 0          TC      OVRLINE1

0699  REF   9  LAST 1053   15,3374  4 1613 0  REFLECT CS      -VT/180        REFLECT LHP INTO RHP REL TO TERM CONTR
0700  REF  10  LAST 1053   15,3375  55=613 0          TS      -VT/180
0701  REF  17  LAST 1053   15,3376  54 021 0          TS      SR             -VT/360  SAVED FOR DZ.
```

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0702  REF  14  LAST 1053   15,3377  4 1614 1          CS    LCX/360
0703  REF  15  LAST 1054   15,3400  55«614 1          TS    LCX/360
0704  REF   4  LAST 1053   15,3401  4 1617 1          CS    JNDX
0705  REF   5  LAST 1054   15,3402  55«617 1          TS    JNDX

R0706   IS VSQ/4API - (VSQ/4API) MIN  NEG  $

0707  REF   2  LAST 1053   15,3403  4 3766 1  DZ1     CS    VSQMIN      IS VSQ/4API - (VSQ/4API) MIN  NEG  $
0708  REF   4  LAST 1053   15,3404  6 1616 1          AD    VSQ/4API
0709                       15,3405  0 0006 1          EXTEND
0710  REF   1              15,3406  6 3410 1          BZMF  DZ2         YES, GO TEST FURTHER.
0711  REF   1              15,3407  1 3415 0          TCF   MAXVTEST    NO

R0712   IS X/360 - XMIN/360 -V1/360  NEG  $

0713  REF   1              15,3410  4 3771 1  DZ2     CS    XMIN/360    XMIN/360 = 4/360
0714  REF  16  LAST 1054   15,3411  6 1614 0          AD    LCX/360
0715  REF  18  LAST 1053   15,3412  6 0021 1          AD    SR          C(SR) = -VT/360
0716                       15,3413  0 0006 1          EXTEND            IS X/360 - XMIN/360 -VT/360  NEG  $
0717  REF   2  LAST 1053   15,3414  6 3676 0          BZMF  DZCALL      YES, IN DZ. EXIT SETTING JETAG=0.

R0718   IS  XD/360 - VM/360K - XS/360   POS  $

0719  REF   6  LAST 1054   15,3415  4 1617 1  MAXVTEST CS    JNDX
0720  REF   3  LAST 1053   15,3416  55«620 0          TS    JNDX1       NOW CAN SET JNDX1 FOR TON2 JETS.
0721  REF   1              15,3417  4 3773 0          CS    XS/360      XS/360 = (XMIN -YMIN/K) /360
0722  REF   5  LAST 1054   15,3420  6 1616 1          AD    VSQ/4API
0723  REF  17  LAST 1054   15,3421  6 1614 0          AD    LCX/360
0724  REF   2  LAST  110   15,3422  55«615 0          TS    XD/360      XD/360= X/360 +VSQ/4API   X INTERCEPT
A0725                                                                  BUT C(XD/360) = (XD - XS) /360
0726  REF   1              15,3423  6 3772 0          AD    -VM/360K    X INTERCEPT FOR MAX V (VM)
0727                       15,3424  4 0000 0          COM
0728                       15,3425  0 0006 1          EXTEND
0729  REF   1              15,3426  6 3434 1          BZMF  MAXVTIM1    YES, THRUST TO VM
0730  REF   3  LAST 1054   15,3427  3 1615 1          CA    XD/360
0731                       15,3430  0 0006 1          EXTEND
0732  REF   1              15,3431  7 4675 0          MP    KTRCS
0733                       15,3432  20 001 1          DDOUBL            GO SAVE PREDICTED DRIFTING VELOCITY.

0734  REF   1              15,3433  0 3437 1          TC    GETON1      INSURE THAT Q IS POS AS TAG.
0735                       15,3434  0 0006 1  MAXVTIM1 EXTEND
0736                       15,3435  22 007 0          ZQ                SET +0 AS TAG
0737  REF   1              15,3436  4 3772 1          CS    -VMT/180
0738  REF   1              15,3437  55«567 0  GETON1   TS    VDT/180     VDT/180 OR VMT/180.
0739  REF  11  LAST 1053   15,3440  6 1613 1          AD    -VT/180
0740                       15,3441  6 0000 1          DOUBLE
0741                       15,3442  0 0006 1          EXTEND
0742  REF   2  LAST 1053   15,3443  7 3767 0          MP    180/8ATT
0743  REF   2  LAST  111   15,3444  55«621 1          TS    TON1        TON1 / 4T
```

```
0744                          15,3445  0 0006 1          EXTEND
0745  REF   1                 15,3446  6 3450 0          BZMF  OVRLINE
0746  REF   1                 15,3447  0 3482 1          TC    GETON2          RESET Q POS IF CAME FROM MAXVTIM1

0747  REF 209  LAST 1046      15,3450  10 002 1 OVRLINE  CCS   Q
0748  REF   2  LAST 1053      15,3451  1 3456 1          TCF   OVRLINE1
0749  REF   4  LAST 1054      15,3452  3 1820 1 MAXVTIM2 CA    JNDX1           ABOVE VM, SO THRUST DOWN
0750  REF   7  LAST 1054      15,3453  55=617 1          TS    JNDX
0751  REF   3  LAST 1054      15,3454  4 1621 1          CS    TON1
0752  REF   1                 15,3455  1 3461 0          TCF   OVRLINE2 +1

0753  REF  12  LAST 1054      15,3456  4 1813 0 OVRLINE1 CS    -VT/180         DRIFT AT V
0754  REF   2  LAST 1054      15,3457  55=587 0          TS    VDT/180
0755  REF 200  LAST 1048      15,3460  3 4714 1 OVRLINE2 CA    ZERO
0756  REF   4  LAST 1055      15,3461  55=621 1          TS    TON1
0757  REF   3  LAST 1055      15,3462  3 1567 1 GETON2   CA    VDT/180         VDT/180, OR VMT/180 OR VT/180
0758                          15,3463  6 0000 1          DOUBLE
0759                          15,3464  0 0006 1          EXTEND
0760  REF   3  LAST 1054      15,3465  7 3787 0          MP    180/8ATT
0761                          15,3466  6 0000 1          DOUBLE          FOR SECOND BURN, A1
0762  REF   2  LAST  110      15,3467  55=607 0          TS    TON2            = TON2 / 4T

0763                          15,3470  4 0000 0          COM
0764                          15,3471  0 0006 1          EXTEND
0765  REF   1                 15,3472  6 3476 1          BZMF  GETOFF
0766  REF   3  LAST 1055      15,3473  55=607 0          TS    TON2
07661 REF   8  LAST 1055      15,3474  3 1617 0          CA    JNDX
07882 REF   5  LAST 1055      15,3475  55=620 0          TS    JNDX1

0767  REF   4  LAST 1055      15,3476  4 1607 0 GETOFF   CS    TON2            TON2 / 4T
0768                          15,3477  0 0008 1          EXTEND
0769  REF   4  LAST 1055      15,3500  7 1567 0          MP    VDT/160         VDT/160, OR VT/160, OR VMT/180.
0770  REF   4  LAST 1054      15,3501  55=615 0          TS    XD/360          USE AS TEMP
0771  REF   5  LAST 1055      15,3502  4 1567 0          CS    VDT/160
07711                         15,3503  0 0006 1          EXTEND
07712 REF   1                 15,3504  1 3520 1          BZF   TOFFOVFL        OMIT THE DIVIDE IF DEN = 0.
0772  REF  13  LAST 1055      15,3505  6 1613 1          AD    -VT/160
0773                          15,3506  0 0006 1          EXTEND
0774  REF   5  LAST 1055      15,3507  7 1621 1          MP    TON1            TON1 /4T
0775  REF   5  LAST 1055      15,3510  6 1615 1          AD    XD/360          TEMP = -VDT/180 / 2 TON2
0776  REF  18  LAST 1054      15,3511  6 1614 0          AD    LCX/360
0777                          15,3512  22 007 0          ZL
0778  REF 148  LAST 1053      15,3513  56 001 0          XCH   L               TEST THE DIVIDE
0779                          15,3514  0 0006 1          EXTEND
0780  REF   6  LAST 1055      15,3515  11=567 0          DV    VDT/180
0781                          15,3516  0 0008 1          EXTEND
0782  REF   1                 15,3517  1 3522 0          BZF   GETOFF2         DIVIDE OK

0787  REF   1                 15,3520  3 4740 0 TOFFOVFL CA    2JETT           OVFL, USE  2T  FOR CONVENIENCE.
0788  REF   1                 15,3521  1 3527 0          TCF   TIMSCAL
```

```
0796  REF 149  LAST 1055   15,3522  56 001 0  GETOFF2  XCH   L          GET NUMERATOR.
0797                       15,3523  0 0006 1           EXTEND
0798  REF   7  LAST 1055   15,3524  11=567 0           DV    VDT/180    C(A) = TOFF / 2T
0799                       15,3525  0 0006 1           EXTEND
0800  REF   2  LAST 1055   15,3526  7 4740 1           MP    2JETT
0801  REF   2  LAST  110   15,3527  55=605 1  TIMSCAL   TS    TOFF       IN CS

0802  REF   1              15,3530  3 3770 1           CAF   4JETT
0803                       15,3531  0 0006 1           EXTEND
0804  REF   6  LAST 1055   15,3532  7 1621 1           MP    TON1       C(TON1) = TON1 / 4T
0805  REF   7  LAST 1056   15,3533  55=621 1           TS    TON1       IN CS

0806  REF   2  LAST 1056   15,3534  3 3770 1           CAF   4JETT
0807                       15,3535  0 0006 1           EXTEND
0808  REF   5  LAST 1055   15,3536  7 1607 0           MP    TON2       C(TON2) = TON2 / 4T
0809  REF   6  LAST 1056   15,3537  55=607 0           TS    TON2       IN CS

0810  REF 201  LAST 1055   15,3540  3 4714 1           CA    ZERO       CANNOT REDO AFTER TIMETST. TUSED GONE
0811  REF   9  LAST 1051   15,3541  55=711 0           TS    JETAG      SET +0 TO SHOW ROLL DAP CALLED.

A0812                                                                  CAUSE THE TM OF BODY RATES VIA UPBUFF TO BE
A0813                                                                  INITIALIZED. ALSO CAUSE NEEDLES TO BE DONE ON NEXT
A0814                                                                  AND ON ALTERNATE PASSES THROUGH CM/DUMPR.

0815  REF 125  LAST 1052   15,3542  3 4712 1           CA    ONE
0816  REF   2  LAST 1039   15,3543  54 305 0           TS    SW/NDX
```

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P0617   TIMETEST SECTION FOR RCS
R0616   ENTER WITH THREE TIME INTERVALS AND THE CORRESPONDING JET CODE INDEXES IN ERASEABLE LOCS TON1, TOFF, TON2, JNDX
R0620   JNDX1.  SECTION PROCESSES TIME INTERVALS FOR WTLST CALLS AND ASSURES THAT WTLST CALLS ARE MADE ONLY
R0622   (1) FOR POS INTERVALS GREATER THAN A SPECIFIED MINIMUM ( HERE CHOSEN AS  2 CS) AND
R0624   (2) FOR THE INTERVALS THAT WILL BE EXECUTED WITHIN THE TIME REMAINING IN THE SAMPLE INTERVAL T  (2 SEC).
R0626   TIMETST  ESTABLISHES 6 LOCS CONTAINING JET CODES AND CORRESPONDING TIME  INTERVALS. THUS' TON1, T1BITS,
R0626   TOFF, TBITS,  TON2, T2BITS.  OF THESE THE FIRST 2 LOCS ARE TEMPORARY, FOR IMMEDIATE ACTION, IN GENERAL.
R0630   SECTION JETCALL  BELOW PROCESSES THIS LIST.

 0631   REF  16  LAST 1051   15,3544  3 0025 0  TIMETST  CA    TIME1        CORRECT FOR POSSIBLE TIME1 OVFL.
 0632   REF   6  LAST 1052   15,3545  6 4675 1           AD    POS1/2
 0633   REF   7  LAST 1057   15,3546  6 4675 1           AD    POS1/2       OVFL GUARANTEED.
 0634   REF   3  LAST 1051   15,3547  27#712 0           ADS   TUSED        B(TUSED) =-TUSED =-OLTIME1

 0635   REF   1              15,3550  3 3765 0           CA    -T-3         =-T +2 -5  (SEE SETJTAG)
A0636                                                                      THE +2 REQUIRED FOR PROPER BRANCH.
 0637   REF   4  LAST 1057   15,3551  27#712 0           ADS   TUSED        TUSED = TIME(K)-TIME(K-1)-T+2

 0636   REF  46  LAST 1014   15,3552  4 4711 0           CS    TWO          USE 2 SINCE TIME3 UNCERTAIN TO 1
 0639   REF   6  LAST 1056   15,3553  6 1621 0           AD    TON1
 0640                        15,3554  0 0006 1           EXTEND
 0641   REF   1              15,3555  6 3567 0           BZMF  TIMETST1
 0642   REF   9  LAST 1055   15,3556  51#617 0           INDEX JNDX
 0643   REF   3  LAST 1049   15,3557  3 3225 1           CAF   P/RJCODE
 0644   REF   2  LAST  111   15,3560  55#622 1           TS    T1BITS

 0645   REF   9  LAST 1057   15,3561  3 1621 0           CA    TON1
 0646   REF   5  LAST 1057   15,3562  27#712 0           ADS   TUSED
 0647                        15,3563  0 0006 1           EXTEND
 0648   REF   1              15,3564  6 3571 1           BZMF  TOFFTEST
 0649   REF 202  LAST 1056   15,3565  3 4714 1           CA    ZERO
 0650   REF   1              15,3566  1 3622 0           TCF   TIMETST3
 0651   REF 126  LAST 1056   15,3567  4 4712 0  TIMETST1 CS    ONE
 0652   REF  10  LAST 1057   15,3570  55#621 1           TS    TON1
 0653   REF  49  LAST 1057   15,3571  4 4711 0  TOFFTEST CS    TWO
 0654   REF   3  LAST 1056   15,3572  6 1605 0           AD    TOFF
 0655                        15,3573  0 0006 1           EXTEND
 0656   REF   1              15,3574  6 3603 1           BZMF  TIMETST2
 0657   REF   4  LAST 1057   15,3575  3 1605 0           CA    TOFF
 0658   REF   6  LAST 1057   15,3576  27#712 0           ADS   TUSED
 0659                        15,3577  0 0006 1           EXTEND
 0660   REF   1              15,3600  6 3605 1           BZMF  TON2TEST
 0661   REF 203  LAST 1057   15,3601  3 4714 1           CA    ZERO
 0662   REF   1              15,3602  1 3624 0           TCF   TIMETST4
 0663   REF 127  LAST 1057   15,3603  4 4712 0  TIMETST2 CS    ONE
 0664   REF   5  LAST 1057   15,3604  55#605 1           TS    TOFF
 0665   REF  50  LAST 1057   15,3605  4 4711 0  TON2TEST CS    TWO
 0666   REF   7  LAST 1056   15,3606  6 1607 1           AD    TON2
 0667                        15,3607  0 0006 1           EXTEND
 0668   REF   1              15,3610  6 3625 0           BZMF  TIMETST5
```

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0869  REP   6  LAST 1055   15,3611  51=620 1            INDEX  JNDX1
0870  REP   4  LAST 1057   15,3612  3 3225 1            CAP    P/RJCODE
0871  REP   2  LAST  110   15,3613  55=610 0            TS     T2BITS
0872  REP   8  LAST 1057   15,3614  3 1607 1            CA     TON2
0873  REP   7  LAST 1057   15,3615  27=712 0            ADS    TUSED
0874                       15,3616  0 0006 1            EXTEND
0875  REP   1               15,3617  6 3627 1            BZMF   JETCALL1
0876  REP 204  LAST 1057   15,3620  3 4714 1            CA     ZERO
0877  REP   2  LAST 1057   15,3621  1 3626 1            TCF    TIMETST5 +1
0878  REP  11  LAST 1057   15,3622  55=621 1  TIMETST3   TS     TON1
0879  REP 128  LAST 1057   15,3623  4 4712 0            CS     ONE
0880  REP   6  LAST 1057   15,3624  55=605 1  TIMETST4   TS     TOFF
0881  REP 129  LAST 1058   15,3625  4 4712 0  TIMETST5   CS     ONE
0882  REP   9  LAST 1058   15,3626  55=607 0            TS     TON2

R0883  SECTION  JETCALL  EXAMINES CONTENTS OF JET TIMES IN LIST, ESTABLISHES WTLST ENTRIES, AND EXECUTES CORRESPONDING
R0885  JET CODES. A POSITIVE NZ NUMBER IN A TIME REGISTER INDICATES THAT A WTLST CALL IS TO BE MADE, AND ITS JET BITS
R0887  EXECUTED. A +0 INDICATES THAT THE TIME INTERVAL DOES NOT APPLY, BUT THE  CORRESPONDING JET BITS ARE TO BE
R0889  EXECUTED. A NEG NUMBER INDICATES THAT THE TIME INTERVAL HAS BEEN PROCESSED. IN EVENT OF +0 OR -1, THE
R0891  SUBSEQUENT TIME REGISTER IS EXAMINED FOR POSSIBLE ACTION. THUS JET BITS TO BE EXECUTED MAY COME FROM MORE
R0893  THAN ONE REGISTER.

0894  REP 205  LAST 1058   15,3627  3 4714 1  JETCALL1  CA     ZERO
0895  REP   2  LAST  110   15,3630  55=611 1            TS     OUTTAG
0896  REP   2  LAST  110   15,3631  55=612 1            TS     NUJET
0897  REP   2  LAST  110   15,3632  55=606 1            TS     TBITS
0898  REP  12  LAST 1058   15,3633  53=622 1            DXCH   TON1
0899  REP 259  LAST 1052   15,3634  10 000 0            CCS    A
0900  REP   1               15,3635  1 3652 1            TCF    JETCALL2        CALL WTLST
0901  REP   3  LAST 1058   15,3636  23=612 0  JETCALL3  LXCH   NUJET           WTLST ENTRIES COME HERE FROM JETCALL
0902  REP 130  LAST 1058   15,3637  4 4712 0            CS     ONE
0903  REP   7  LAST 1058   15,3640  53=606 1            DXCH   TOFF
0904  REP 260  LAST 1058   15,3641  10 000 0            CCS    A
0905  REP   2  LAST 1058   15,3642  1 3652 1            TCF    JETCALL2        CALL WTLST
0906  REP   4  LAST 1058   15,3643  23=612 0            LXCH   NUJET
0907  REP 131  LAST 1058   15,3644  4 4712 0            CS     ONE
0908  REP  10  LAST 1058   15,3645  53=610 0            DXCH   TON2
0909  REP 261  LAST 1058   15,3648  10 000 0            CCS    A
0910  REP   3  LAST 1058   15,3647  1 3652 1            TCF    JETCALL2        CALL WTLST
0911  REP   5  LAST 1058   15,3650  23=612 0            LXCH   NUJET
0912  REP   1               15,3651  0 3661 0            TC     JETACTN         C(A) = +0
0913  REP 150  LAST 1056   15,3652  56 001 0  JETCALL2  XCH    L               SAVE JET BITS FOR AFTER WTLST CALL
0914  REP   6  LAST 1058   15,3653  27=612 1            ADS    NUJET
0915  REP 151  LAST 1058   15,3654  56 001 0            XCH    L
0916  REP 132  LAST 1058   15,3655  6 4712 1            AD     ONE             RESTORE FOR CCS
0917  REP  49  LAST 1048   15,3658  0 5140 1            TC     WAITLIST
0918  REP  40  LAST 1048   E6,1661                      EBANK= ACC
0919  REP   1               15,3657   03667 0           2CADR  JETCALL
0919  REP   1               15,3660   32066 0
0920  REP   7  LAST 1058   15,3661  3 1612 0  JETACTN   CA     NUJET           COME HERE WHEN DESIRED JET CODE IS KNOWN
```

```
 0921                        15,3662  0 0006 1          EXTEND              NO NEED TO SAVE OLD CODES
 0922  REP   4  LAST 1049    15,3663  01 006 0          WRITE  ROLLJETS     SET RCHAN TO NEW BIT CONFIG.

 0923  REP   3  LAST 1058    15,3664  11«611 1          CCS    OUTTAG
 0924  REP  55  LAST 1051    15,3665  0 5213 1          TC     TASKOVER
 0925  REP   2  LAST 1045    15,3666  0 3724 0 ROLLDUMP TC     CM/FDAIR

A0926                                                          EDIT DUMP AT ABOVE LOCATION.

R0927   WAITLIST ENTRIES COME HERE.

 0928  REP  42  LAST  982    15,3667  3 4711 1 JETCALL  CAF    BIT2          CM/DSTBY =103D BIT2
 0929  REP   4  LAST 1059    15,3670  55«611 1          TS     OUTTAG        SIGNIFY WTLST ENTRY
 0930  REP  23  LAST 1051    15,3671  7 0102 0          MASK   CM/FLAGS      IS SYSTEM DISABLED  $
 0931                        15,3672  0 0006 1          EXTEND
 0932  REP   2  LAST 1058    15,3673  1 3662 1          BZF    JETACTN +1    YES, QUENCH ROLL JETS, IF ON AND EXIT.
 0933                        15,3674  22 007 0          ZL                   NO, CONTINUE.
 0934  REP   1                15,3675  1 3636 0          TCF    JETCALL3      C(A) POS, C(L) =+0

R0935    DEAD ZONE ENTRIES COME HERE.

09351  REP  11  LAST 1052    15,3676  4 1700 0 DZCALL   CS     CMDAPMOD      POSSIBLE VALUES OF CMDAPMOD' -1, +0, -0.
09352  REP  73  LAST 1038    15,3677  7 4712 0          MASK   BIT1
09353  REP 152  LAST 1058    15,3700  54 001 1          TS     L             C(L)=0 FOR -0
```

```
 09354  REF 262  LAST 1058   15,3701  50 000 1          INDEX  A        ERASBLE ORDER' ROLLTM,ROLLC,ROLLC +1.
 09355  REF   4  LAST 1045   15,3702  3 1714 1          CA     ROLLTM   GET ROLL/180 OR ROLLC  (/360).
 09356  REF 153  LAST 1059   15,3703  50 001 0          INDEX  L
 09357  REF 263  LAST 1059   15,3704  54 000 0          TS     A        IF C(L)=1, STORE «ROLLC« IN «L«.
 09358  REF 154  LAST 1059   15,3705  6 0001 0          AD     L        (BOTH MUST BE SCALED DEG/180)
 09359  REF   5  LAST 1045   15,3706  0 2542 0          TC     ANGOVCOR C(A)=ROLL/180  OR  2 ROLLC  .
 0936   REF   4  LAST 1049   15,3707  55«717 0          TS     ROLLHOLD IF CMDAPMOD =-0, SAVE ROLL ANGLE,
A09361                                                                      OTHERWISE, SAVE ROLL COMMAND.

 09362  REF 206  LAST 1058   15,3710  3 4714 1          CA     ZERO     COME HERE IF IN DZ, AND CANCEL JETS.
 0937                        15,3711  0 0006 1          EXTEND          INHINT NOT NEEDED HERE.
 0938   REF   5  LAST 1059   15,3712  01 006 0          WRITE  ROLLJETS TURN OFF ALL ROLL JETS.
 0939   REF   8  LAST 1056   15,3713  55«567 0          TS     VDT/180  SET =0 TO SHOW IN DEAD ZONE.
 0940   REF  10  LAST 1056   15,3714  55«711 0 DZCALL1  TS     JETAG    COME HERE WITH C(A)=0.
 0941   REF   1              15,3715  0 3666 1          TC     ROLLDUMP
```

L CM ENTRY DIGITAL AUTOPILOT USER=S PAGE NO. 27 E6 S3

P0942 CM ENTRY FDAI DISPLAY

R0943 CALCULATE BY INTEGRATION THE ROLL ERROR BETWEEN THE 2 SEC CM/RCS UPDATES . DISPLAY ATTITUDE ERRORS AS FOLLOWS'
R0945 ATM DAP' DISPLAY ONLY ROLL ATTITUDE ERROR.
R0946 EXT ATM DAP' PRESENT 3 ATTITUDE ERRORS RELATIVE TO THE APPROPRIATE BODY AXES EACH .1 SEC.
R0948 ROLL ROLLC-ROLL
R0949 PITCH ALPAC-ALPA
R0950 YAW BETAC-BETA

R0951 DURING ENTRY, THE FDAI NEEDLES HAVE FULL SCALE OF 87.5 DEG IN ROLL AND 18.875 DEG IN PITCH AND YAW.
R0953 THE SUBROUTINE NEEDLER EXPECTS (ANGLE/180) AND SCALES TO 18.875 DEG FULL SCALE.

```
A0958                                                          COME HERE EACH .1 SEC. (CMDAPMOD=+1 COMES BELOW)
 0959  REF   7  LAST 1045   15,3716  4 1705 0  CM/FDA1  CS      PHIDOT      INTEGRATE ROLL ERROR =TWEEN 2SEC UPDATES
 0980                       15,3717  0 0008 1           EXTEND
 0981  REF   8  LAST 1052   15,3720  7 1508 1           MP      CALPA       FOR ASSUMED COORDINATION.
 0982                       15,3721  0 0008 1           EXTEND
 0983  REF   6  LAST 1049   15,3722  7 4875 0           MP      HALF
 0984  REF   7  LAST 1052   15,3723  27=713 1           ADS     PAXERR1     ROLL ERROR/380.   OVFL OK.

A0965                                                          EDIT DUMP AT ABOVE LOCATION.
 0968  REF   7  LAST 1080   15,3724  3 4875 1  CM/FDAIR CA      HALF
 0987                       15,3725  0 0008 1           EXTEND
 0988  REF   8  LAST 1080   15,3726  7 1713 1           MP      PAXERR1     FULL SCALE FOR FDAI (ROLL) IS 87.5 D
 0989  REF   1              15,3727  55=478 1           TS      PAXERR      .25 (ROLL ERROR/180) FOR FDAI NEEDLE.

A0970                                                          PROGRAM TO FILE BODY RATES FOR TM ON ONE PASS AND
A0971                                                          TO UPDATE THE NEEDLE DISPLAY ON THE NEXT.
A0972                                                          SYNCHRONIZATION WITH CM/RCS IS USED SO THAT THE TM
A0973                                                          IS DONE WITH THE ROLL SYSTEM AND NEEDLES START ON
A0974                                                          THE SUBSEQUENT PASS.
A0975

 0976  REF   3  LAST 1058   15,3730  4 0305 0  CM/DUMPR CS      SW/NDX      COMBINED ALTERNATION SWITCH AND FILE
 09781 REF   4  LAST 1080   15,3731  54 305 0           TS      SW/NDX
 0977                       15,3732  0 0006 1           EXTEND              INDEX.
 0978  REF   1              15,3733  6 3737 1           BZMF    CMTMFILE    FILE STARTS WITH SW/NDX +1 AND GOES TO
A0979                                                                       ENDBUF.
A0980                                                                       INDEX IS POS FOR NEEDLES

 0981  REF  38  LAST  985   15,3734  0 4833 0           TC      IBNKCALL
 0982  REF   9  LAST  983   15,3735   42404 1           CADR    NEEDLER

 0983  REF   1              15,3736  0 3755 0           TC      CM/END

A0984                                                                       INDEX IS NEG FOR TM FILE

 0985  REF  39  LAST 1035   15,3737  8 8214 0  CMTMFILE AD      THREE
 0986                       15,3740  0 0008 1           EXTEND
 0987  REF   1              15,3741  6 3745 1           BZMF    SAVENDX
```

```
 0988  REF  17  LAST 1057   15,3742  3 0025 0          CA     TIME1          INITIALIZE THE TM LIST IN UPBUFF.
 0989  REF   3  LAST   70   15,3743  54 304 1          TS     CMTMTIME
 0990  REF   3  LAST  825   15,3744  4 4720 1          CS     THIRTEEN        INITIALIZE COUNTER
 0991  REF   5  LAST 1060   15,3745  54 305 0  SAVENDX  TS     SW/NDX         A NEGATIVE NUMBER.
 0992                       15,3746  0 0006 1          EXTEND
 0993  REF   8  LAST 1051   15,3747  3 1702 0          DCA    PREL
 0994  REF   6  LAST 1061   15,3750  50 305 1          INDEX  SW/NDX
 0995  REF   2  LAST   70   15,3751  52 324 0          DXCH   ENDBUF -1
 0996  REF   8  LAST 1048   15,3752  3 1703 1          CA     RREL
 0997  REF   7  LAST 1061   15,3753  50 305 1          INDEX  SW/NDX
 0998  REF   3  LAST 1061   15,3754  54 325 1          TS     ENDBUF +1

 0999  REF   3  LAST 1044   15,3755  3 1623 1  CM/END   CA     CM/SAVE
 1000  REF  19  LAST 1054   15,3756  54 021 0          TS     SR
A1001                                                       DOES NOT PROTECT TEMK, SQ IN SPSIN/COS

 1002                       15,3757  0 0006 1          EXTEND
 1003  REF   1              15,3760  3 3764 1          DCA    T5IDLER2
 1004  REF  25  LAST 1043   15,3761  53=313 0          DXCH   T5LOC
 1005  REF  46  LAST 1033   15,3762  0 5222 0          TC     RESUME

 1006  REF  26  LAST 1061      1312                    EBANK= T5LOC
 1007  REF   7  LAST 1040   15,3763   03143 1  T5IDLER2 2CADR  T5IDLOC
 1007                       15,3764   12062 0
A1008                                                       DEFINE THE FOLLOWING 17D REGISTERS IN UPBUFF TO BE
A1009                                                       USED TO TELEMETER CM VEHICLE BODY RATE INFORMATION.
A1010                                                       THE INFORMATION IS FILED EACH 0.2 SEC, GIVING 15D
A1011                                                       DATA POINTS EACH 1 SEC.  TM LIST IS READ TWICE
A1012                                                       EACH 2 SECONDS.

A1013                                                       THE SEQUENCE IS'   SP TIME      INITIAL TIME
A1014                                                                          SWITCH       ALSO INDEX.
A1015                                                                          P            ROLL RATE
A1016                                                                          Q            PITCH RATE
A1017                                                                          R            YAW RATE
A1018                                                                          ETC.

A1019                                          CMTMTIME =  UPBUFF
A1020                                          SW/NDX   =  UPBUFF  +1
A1021                                          ENDBUF   =  UPBUFF  +16D
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P10211  SPACER

R1022   CONSTANTS USED IN THE ROLL CONTROL SYSTEM'
R1023   CONSTANTS ARE THE FOLLOWING' A = 9.1 DEG/SEC SQ, VM = 20 DEG/SEC,        T = 2 SEC,  TCDU = .1 SEC,
R1025   XMIN = 4 DEG, VMIN = 2 DEG/SEC, K = .25, A1 = 4.55 DEG/SEC SQ,          VI = 1 DEG/SEC, INTERCEPT WITH DZ SIDE
R1027   XBUF = 4 DEG

 1028                          15,3765  77464 1  -T-3      DEC  -203              CS
 1029                          15,3766  00012 1  VSQMIN    DEC  .61050061 E-3     VSQ MIN/4 A PI = 4/(4  (9.1)  180)
 1030   REF  3  LAST  265        4726           2T/TCDU    =    CCT50             T/TCDU  EXP-14   TCDU =.1SEC
 1031                          15,3767  23617 0  180/8ATT  DEC  .61813167        180/(8  (9.1) 4)=(180/ATT)  EXP -3
 1032   REF  2  LAST 1054      15,3772           -VMT/180   =    -VM/360K          = 20  (2) / 180
 1033   REF  3  LAST  576        4740           2JETT      =    4SECS             CS          2 (2) 100   INTEGER
 1034                          15,3770  01440 0  4JETT     DEC  600               CS          4 (2) 100   INTEGER
 1035                          15,3771  00266 0  XMIN/360  DEC  182             XMIN/360 = 4/ 360  EXP 14 = 182 INTEGER
 1036                          15,3772  70706 1  -VM/360K  DEC  -.22222222       =-20/( 360  (.25))
 1037   REF  4  LAST 1055      15,3767           1/16A1     =    180/8ATT
A10371                                                          1/16A1  = 180/(16 A1 TT)
A1038                                                           =180/(16  4.55  4)
 1039                          15,3773  00133 0  XS/360    DEC  91                =(XMIN +VI (T-1/K))/360 = 2/360 EXP 14
 1040   REF  2  LAST 1054      15,3773           BUFLIM     =    XS/360            4/(2  360)

 1041   REF  6  LAST 1060        4675           KTRCS      =    HALF              KT = (.25) 2 = .5
*** END OF DAPCSM .195 ***
```

L DOWN-TELEMETRY PROGRAM USER«S PAGE NO. 1 E0 S3

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R0001   PROGRAM NAME- DOWN TELEMETRY PROGRAM
R0002   MOD NO.- 0      TO COMPLETELY REWRITE THE DOWN TELEMETRY PROGRAM AND DOWNLINK ERASABLE DUMP PROGRAM FOR THE
R0004                   PURPOSE OF SAVING APPROXIMATELY 150 WORDS OF CORE STORAGE.
R0006                   THIS CHANGE REQUIRES AN ENTIRELY NEW METHOD OF SPECIFYING DOWNLINK LISTS.REFER TO DOWNLINK
R0008                   LISTS LOG SECTION FOR MORE DETAILS. HOWEVER THIS CHANGE WILL NOT AFFECT THE GROUND PROCESSING
R0010                   OF DOWN TELEMETRY DATA.
R0011   MOD BY-  KILROY, SMITH, DEWITT
R0012   DATE-    02OCT67
R0013   AUTHORS- KILROY, SMITH, DEWITT, DEWOLF, PAGIN
R0014   LOG SECTION- DOWN-TELEMETRY PROGRAM
R0015   FUNCTIONAL DESCRIPTION- THIS ROUTINE IS INITIATED BY TELEMETRY END
R0016           PULSE FROM THE DOWNLINK TELEMETRY CONVERTER. THIS PULSE OCCURS
R0017           AT 50 TIMES PER SEC(EVERY 20 MS) THEREFORE DODOWNTM IS
R0018           EXECUTED AT THESE RATES. THIS ROUTINE SELECTS THE APPROPRIATE
R0019           AGC DATA TO BE TRANSMITTED DOWNLINK AND LOADS IT INTO OUTPUT
R0020           CHANNELS 34 AND 35. THE INFORMATION IS THEN GATED OUT FROM THE
R0021           LGC IN SERIAL FASHION.
R0022           THIS PROGRAM IS CODED FOR A 2 SECOND DOWNLIST. SINCE DOWNRUPTS
R0023           OCCUR EVERY 20MS AND 2 AGC COMPUTER WORDS CAN BE PLACED IN
R0024           CHANNELS 34 AND 35 DURING EACH DOWNRUPT THE PROGRAM IS CAPABLE
R0025           OF SENDING 200 AGC WORDS EVERY 2 SECONDS.
R0026   CALLING SEQUENCE- NONE
R0027           PROGRAM IS ENTERED VIA TCF DODOWNTM WHICH IS EXECUTED AS A
R0028           RESULT OF A DOWNRUPT. CONTROL IS RETURNED VIA TCF RESUME WHICH
R0029           IN EFFECT IS A RESUME.
R0030   SUBROUTINES CALLED- NONE
R0031   NORMAL EXIT MODE- TCF RESUME
R0032   ALARM OR ABORT EXIT MODE- NONE
R0033   RESTART PROTECTION'
R0034           ON A FRESH START AND RESTART THE «STARTSUB« SUBROUTINE WILL INITIALIZE THE DOWNLIST POINTER(ACTUALLY
R0036           DNTMGOTO) TO THE BEGINNING OF THE CURRENT DOWNLIST(I.E. CURRENT CONTENTS OF DNLSTADR). THIS HAS THE
R0038           EFFECT OF IGNORING THE REMAINDER OF THE DOWNLIST WHICH THE DOWN-TELEMETRY PROGRAM WAS WORKING ON WHEN
R0040           THE RESTART(OR FRESH START) OCCURRED AND RESUME DOWN TELEMETRY FROM THE BEGINNING OF THE CURRENT
R0042           DOWNLIST.
R0043           ALSO OF INTEREST IS THE FACT THAT ON A RESTART THE AGC WILL ZERO DOWNLINK CHANNELS 13, 34 AND 35.
R0047   DOWNLINK LIST SELECTION'
R0048           THE APPROPRIATE DOWNLINK LISTS ARE SELECTED BY THE FOLLOWING'
R0049           1. FRESH START
R0050           2. V37EXXE  WHERE XX = THE MAJOR MODE BEING SELECTED.
R0051           3. UPDATE PROGRAM(P27)
R0052           4.      NON-V37 SELECTABLE TYPE PROGRAMS(E.G. AGS INITIALIZATION(SUNDANCE,LUMINARY) AND P61-P62
                        TRANSITION(COLOSSUS) ETC.).
R00522
R00525  DOWNLINK LIST RULES AND LIMITATIONS'
R00526          READ SECTION(S) WHICH FOLLOW «DEBRIS« WRITEUP.
R0053   OUTPUT-  EVERY 2 SECONDS 100 DOUBLE PRECISION WORDS(I.E. 200 LGC
R0054           COMPUTER WORDS) ARE TRANSMITTED VIA DOWNLINK.
R0055   ERASABLE INITIALIZATION REQUIRED- NONE
R0056           «DNTMGOTO« AND «DNLSTADR« ARE INITIALIZED BY THE FRESH START PROGRAM.
R0058   DEBRIS(ERASABLE LOCATIONS DESTROYED BY THIS PROGRAM)-
R0059           LDATALST,DNTMBUFF TO DNTMBUFF +21D,TMINDEX,DNQ.
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P0065  DODOWNTM IS ENTERED EVERY 20 MS BY AN INTERRUPT TRIGGERED BY THE
R0066  RECEIPT OF AN ENDPULSE FROM THE SPACECRAFT TELEMETRY PROGRAMMER.

R0067  NOTES REGARDING DOWNLINK LISTS ASSOCIATED WITH THIS PROGRAM'
R0068  1. DOWNLISTS. - DOWNLISTS MUST BE COMPILED IN THE SAME BANK AS THE
R0069     DOWN-TELEMETRY PROGRAM. THIS IS DONE FOR EASE OF CODING, FASTER
R0070     EXECUTION.
R0075  2. EACH DOWNLINK LIST CONSISTS OF A CONTROL LIST AND A NUMBER OF
R0076     SUBLISTS.
R0077  3. A SUBLIST REFERS TO A SNAPSHOT OR DATA COMMON TO THE SAME OR OTHER
R0078     DOWNLINK LISTS.  ANY SUBLIST CONTAINING COMMON DATA NEEDS TO BE
R0079     CODED ONLY ONCE FOR THE APPLICABLE DOWNLINK LISTS.
R0080  4. SNAPSHOT SUBLISTS REFER SPECIFICALLY TO HOMOGENOUS DATA WHICH MUST BE
R0081     SAVED IN A BUFFER DURING ONE DOWNRUPT.
R0082  5. THE 1DNADR FOR THE 1ST WORD OF SNAPSHOT DATA IS FOUND AT THE END
R0083     OF EACH SNAPSHOT SUBLIST, SINCE THE PROGRAM CODING SENDS THIS DP WORD
R0084     IMMEDIATELY AFTER STORING THE OTHERS IN THE SNAPSHOT BUFFER.
R0085  6. ALL LISTS ARE COMBINATIONS OF CODED ERASABLE ADDRESS CONSTANTS
R0088     CREATED FOR THE DOWNLIST PROGRAM.
R0087        A. 1DNADR              1-WORD DOWNLIST ADDRESS.
R0088           SAME AS ECADR, BUT USED WHEN THE WORD ADDRESSED IS THE LEFT
R0089           HALF OF A DOUBLE-PRECISION WORD FOR DOWN TELEMETRY.
R0090        B. 2DNADR - 6DNADR     N-WORD DOWNLIST ADDRESS, N = 2 - 8.
R0091           SAME AS 1DNADR, BUT WITH THE 4 UNUSED BITS OF THE ECADR FORMAT
R0092           FILLED IN WITH 0001-0101.  USED TO POINT TO A LIST OF N DOUBLE-
R0093           PRECISION WORDS, STORED CONSECUTIVELY, FOR DOWN TELEMETRY.
R0094        C. DNCHAN              DOWNLIST CHANNEL ADDRESS.
R0095           SAME AS 1DNADR, BUT WITH PREFIX BITS 0111.  USED TO POINT TO
R0096           A PAIR OF CHANNELS FOR DOWN TELEMETRY.
R0097        D. DNPTR               DOWN TELEMETRY SUBLIST POINTER.
R0098         SAME AS CAF BUT TAGGED AS A CONSTANT. USED IN CONTROL LIST TO POINT TO A SUBLIST.
R0100         CAUTION--- A DNPTR CANNOT BE USED IN A SUBLIST.
R0101  7. THE WORD ORDER CODE IS SET TO ZERO AT THE BEGINNING OF EACH DOWNLIST (I.E. CONTROL LIST) AND WHEN
R0103     A «1DNADR TIME2« IS DETECTED IN THE CONTROL LIST(ONLY).
R0104  8. IN THE SNAPSHOT SUBLIST ONLY, THE DNADR«S CANNOT POINT TO THE FIRST WORD OF ANY EBANK.

R0106  DOWNLINK LIST RESTRICTIONS'
R0107    (THE FOLLOWING POINTS MAY BE LISTED ELSEWHERE BUT ARE LISTED HERE SO  IT IS CLEAR THAT THESE THINGS CANNOT BE
R0109    DONE)

R0110  1. SNAPSHOT DOWNLIST'
R0111    (A) CANNOT CONTAIN THE FOLLOWING ECADRS(I.E. 1DNADR«S)' 0, 400, 1000, 1400, 2000, 2400, 3000, 3400.
R0113    (B) CAN CONTAIN ONLY 1DNADR«S

R0114  2. ALL DOWNLINKED DATA(EXCEPT CHANNELS) IS PICKED UP BY A ±DCA±SO DOWNLINK LISTS CANNOT CONTAIN THE
R0118     EQUIVALENT OF THE FOLLOWING ECADRS(I.E. IDNADRS)' 377, 777, 1377, 1777, 2377, 27777, 3377, 3777.

R0118       (NOTE' THE TERM EQUIVALENT « MEANT THAT THE IDNADR  TO 6DNADR  WILL BE PROCESSED LIKE 1 TO 8 ECADRS)

R0120  3. CONTROL LISTS AND SUBLISTS CANNOT HAVE ENTRIES = OCTAL 00000 OR OCTAL 77777
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R0122 4. THE «1DNADR TIME2« WHICH WILL CAUSE THE DOWNLINK PROGRAM TO SET THE WORDER CODE TO 3 MUST APPEAR IN THE
R0124 CONTROL SECTION OF THE DOWNLIST.

R0125 5. «DNCHAN 0« CANNOT BE USED.

R0126 6. «DNPTR 0« CANNOT BE USED.

R0127 7. DNPTR CANNOT APPEAR IN A SUBLIST.

R0128
R0129 EBANK SETTINGS
R0130 IN THE PROCESS OF SETTING THE EBANK(WHEN PICKING UP DOWNLINK DATA) THE DOWN TELEMETRY PROGRAM PUTS
R0132 «GARBAGE« INTO BITS15-12 OF EBANK. HUGH BLAIR-SMITH WARNS US THAT BITS15-12 OF EBANK MAY BECOME
R0134 SIGNIFICANT SOMEDAY IN THE FUTURE. IF/WHEN THAT HAPPENS, THE PROGRAM SHOULD INSURE(BY MASKING ETC.)
R0136 THAT BITS15-12 OF EBANK ARE ZERO.
R0137 INITIALIZATION REQUIRED- TO INTERRUPT CURRENT LIST AND START A NEW ONE..
R0138 1. ADRES OF DOWNLINK LIST INTO DNLSTADR
R0139 2. NEGONE INTO SUBLIST
R0140 3. NEGONE INTO DNECADR

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0142                          22,3505                          BANK    22
0143  REF   2  LAST  166      05,2000                          SETLOC  DOWNTELM
0144                          05,3342                          BANK

0145  REF  23  LAST  175        0340                          EBANK=  DNTMRUPT

0146  REF   1                                                 COUNT   05/DPROG

0147  REF  21  LAST 1044      05,3342  54 016 1  DODOWNTM TS      BANKRUPT
0148                          05,3343   0 0006 1            EXTEND
0149  REF  17  LAST 1044      05,3344  22 012 1            QXCH    QRUPT      SAVE Q
0150  REF  49  LAST 1026      05,3345   3 4704 0            CA      BIT7       SET WORD ORDER CODE TO 1. EXCEPTION- AT
0151                          05,3346   0 0006 1            EXTEND             THE BEGINNING OF EACH LIST THE WORD
0152  REF  12  LAST 1033      05,3347   05 013 0            WOR     CHAN13     CODE WILL BE SET BACK TO 0.
0153  REF   3  LAST  254      05,3350   0 0335 1            TC      DNTMGOTO   GO TO APPROPRIATE PHASE OF PROGRAM

0154  REF  19  LAST  936      05,3351   3 7716 0  DNPHASE1  CA      NEGONE     INITIALIZE ALL CONTROL WORDS
0155  REF   1                 05,3352   54 337 1            TS      SUBLIST    WORDS TO MINUS ONE
0156  REF   1                 05,3353   54 336 0            TS      DNECADR
0157  REF   1                 05,3354   3 3474 0            CA      LDNPHAS2   SET DNTMGOTO =0 ALL SUBSEQUENT DOWNRUPTS
0158  REF   4  LAST 1066      05,3355   54 335 0            TS      DNTMGOTO   GO TO DNPHASE2
0159  REF   1                 05,3356   1 3372 0            TCF     NEWLIST
0160  REF   2  LAST 1066      05,3357   10 336 0  DNPHASE2  CCS     DNECADR    SENDING OF DATA IN PROGRESS
0161  REF   1                 05,3360   0 3507 0  DODNADR   TC      FETCH2WD   YES - THEN FETCH THE NEXT 2 SP WORDS
0162  REF  27  LAST  766      05,3361    77753 0  MINTIME2-1DNADR TIME2      NEGATIVE OF TIME2 1DNADR
0163                          05,3362   I 3363 0            TCF     +1         (ECADR OF  3776 + 74001 = 77777)

0164  REF   2  LAST 1066      05,3363   10 337 1            CCS     SUBLIST    IS THE SUBLIST IN CONTROL
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0165  REF   1                05,3364  1 3522 0            TCF   NEXTINSL     YES
0166                         05,3365   74001 0  DNADRDCR  OCT   74001        DNADR COUNT AND ECADR DECREMENTER

0167  REF   1                05,3366  3 0334 0  CHKLIST   CA    CTLIST
0168                         05,3367  0 0006 1            EXTEND
0169  REF   2  LAST 1068    05,3370  6 3372 1            BZMF  NEWLIST      IT WILL BE NEGATIVE AT END OF LIST
0170  REF   1                05,3371  1 3377 0            TCF   NEXTINCL
0171  REF   5  LAST  746     05,3372  50 332 0  NEWLIST   INDEX DNLSTCOD
0172  REF   1                05,3373  3 2342 0            CA    DNTABLE      INITIALIZE CTLIST WITH
0173  REF   2  LAST 1067    05,3374  54 334 1            TS    CTLIST         STARTING ADDRESS OF NEW LIST
0174  REF   6  LAST 1067    05,3375  4 0332 1            CS    DNLSTCOD
0175  REF   1                05,3376  1 3812 0            TCF   SENDID +3
0177  REF   3  LAST 1067    05,3377  50 334 0  NEXTINCL  INDEX CTLIST
0178                         05,3400  3 0000 1            CA    0
0179  REF 264  LAST 1059    05,3401  10 000 0            CCS   A
0180  REF   4  LAST 1067    05,3402  24 334 0            INCR  CTLIST       SET POINTER TO PICK UP NEXT CTLIST WORD
0181                         05,3403  1 3407 0            TCF   +4           ON NEXT ENTRY TO PROG. (A SHOULD NOT =0)
0182  REF   5  LAST 1067    05,3404  56 334 0            XCH   CTLIST       SET CTLIST TO NEGATIVE AND PLACE(CODING)
0183                         05,3405  4 0000 0            COM                UNCOMPLEMENTED DNADR INTO A.    (FOR LA)
0184  REF   6  LAST 1067    05,3406  56 334 0            XCH   CTLIST                                       (ST IN )
0185  REF 265  LAST 1067    05,3407  24 000 1  +4        INCR  A                                            (CTLIST)
0186  REF   3  LAST 1066    05,3410  54 336 0            TS    DNECADR      SAVE DNADR
0187  REF   1                05,3411  6 3361 0            AD    MINTIME2     TEST FOR TIME2 (NEG. OF ECADR)
0188  REF 266  LAST 1067    05,3412  10 000 0            CCS   A
0189  REF   1                05,3413  1 3417 1            TCF   SETWO +1     DON'T SET WORD ORDER CODE
0190                         05,3414   47777 0  MINB1314 OCT   47777        MINUS BIT 13 AND 14  (CAN'T GET HERE)
0191  REF   2  LAST 1067    05,3415  1 3417 1            TCF   SETWO +1     DON'T SET WORD ORDER CODE
0192  REF   1                05,3416  0 3441 0  SETWO     TC    WOZERO       GO SET WORD ORDER CODE TO ZERO.
0193  REF   4  LAST 1067    05,3417  3 0336 1  +1        CA    DNECADR      RELOAD A WITH THE DNADR.
0194  REF   1                05,3420  6 3414 0  +2        AD    MINB1314     IS THIS A REGULAR DNADR?
0195                         05,3421  0 0006 1            EXTEND
0196  REF   2  LAST 1066    05,3422  6 3507 0            BZMF  FETCH2WD     YES. (A MUST NEVER BE ZERO)
0197  REF   1                05,3423  6 7710 0            AD    MINB12       NO- IS IT A POINTER (DNPTR) OR A
0198                         05,3424  0 0006 1            EXTEND                 CHANNEL(DNCHAN)
0199  REF   1                05,3425  6 3445 1            BZMF  DODNPTR      IT'S A POINTER. (A MUST NEVER BE ZERO)

0200                         05,3426  0 0006 1  DODNCHAN  TC    6            (EXECUTED AS EXTEND) IT S A CHANNEL
0201  REF   5  LAST 1067    05,3427  50 336 1            INDEX DNECADR
0202                         05,3430  44000 1             INDEX 0 -4000      (EXECUTED AS READ)
0203  REF 155  LAST 1059    05,3431  54 001 1            TS    L
0204                         05,3432  0 0006 1            TC    6            (EXECUTED AS EXTEND)
0205  REF   6  LAST 1067    05,3433  50 336 1            INDEX DNECADR
0206                         05,3434  43000 1             INDEX 0 -4001      (EXECUTED AS READ)
0207  REF   7  LAST 1067    05,3435  54 336 0            TS    DNECADR      SET DNECADR
0208  REF  20  LAST 1066    05,3436  3 7716 0            CA    NEGONE           TO MINUS
0209  REF   8  LAST 1067    05,3437  56 336 1            XCH   DNECADR              WHILE PRESERVING A.
0210  REF   1                05,3440  1 3535 0            TCF   DNTMEXIT     GO SEND CHANNELS

0211  REF  50  LAST 1066    05,3441  4 4704 1  WOZERO    CS    BIT7
0212                         05,3442  0 0006 1            EXTEND
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0213   REP  13  LAST 1066   05,3443  03 013 0          WAND   CHAN13        SET WORD ORDER CODE TO ZERO
0214   REP 210  LAST 1055   05,3444  0 0002 0          TC     Q             RETURN TO CALLER

0215   REP   9  LAST 1067   05,3445  50 336 1  DODNPTR INDEX  DNECADR      DNECADR CONTAINS ADRES OF SUBLIST
0216                        05,3446  0 0000 1          0      0             CLEAR AND ADD LIST ENTRY INTO A.
0217   REP 267  LAST 1067   05,3447  10 000 0          CCS    A             IS THIS A SNAPSHOT SUBLIST
0218   REP  10  LAST 1066   05,3450  3 0336 1          CA     DNECADR       NO, IT IS A REGULAR SUBLIST.
0219   REP   1              05,3451  1 3521 0          TCF    DOSUBLST      A MUST NOT BE ZERO.

0220   REP  11  LAST 1066   05,3452  56 336 1          XCH    DNECADR       YES, IT IS A SNAPSHOT SUBLIST.
0221   REP   3  LAST 1066   05,3453  54 337 1          TS     SUBLIST       C(DNECADR) INTO SUBLIST
0222   REP 207  LAST 1059   05,3454  3 4714 1          CAF    ZERO                A     INTO    A
0223   REP   2  LAST  71    05,3455  56 336 1          XCH    TMINDEX       (NOTE.. TMINDEX = DNECADR)
R0224  THE FOLLOWING CODING (FROM SNAPLOOP TO SNAPEND) IS FOR THE PURPOSE OF TAKING A SNAPSHOT OF 12 DP REGISTERS.
R0226  THIS IS DONE BY SAVING 11 DP REGISTERS IN DNTMBUFF AND SENDING THE FIRST DP WORD IMMEDIATELY.
R0228  THE SNAPSHOT PROCESSING IS THE MOST TIME CONSUMING AND THEREFORE THE CODING AND LIST STRUCTURE WERE DESIGNED
R0230  TO MINIMIZE TIME. THE TIME OPTIMIZATION RESULTS IN RULES UNIQUE TO THE SNAPSHOT PORTION OF THE DOWNLIST.
R0232  THESE RULES ARE.....
R0233                1.   ONLY 1DNADR=S CAN APPEAR IN THE SNAPSHOT SUBLIST
R0234                2.   THE 1DNADR=S CANNOT REFER TO THE FIRST LOCATION IN ANY BANK.
0236   REP  42  LAST 1039   05,3456  54 003 0  SNAPLOOP TS     EBANK         SET EBANK
0237   REP   3  LAST  372   05,3457  7 4373 0          MASK   LOW6          ISOLATE RELATIVE ADDRESS
0238                        05,3460  0 0006 1          EXTEND
0239   REP 266  LAST 1066   05,3461  5 0000 1          INDEX  A
0240                        E3,1401                    EBANK= 1401
0241                        05,3462  3 1402 0          DCA    1401           PICK UP 2 SNAPSHOT WORDS.
0242   REP  24  LAST 1066     0340                     EBANK= DNTMBUFF
0243   REP   3  LAST 1066   05,3463  50 336 1          INDEX  TMINDEX
0244   REP  25  LAST 1066   05,3464  52 341 0          DXCH   DNTMBUFF       STORE 2 SNAPSHOT WORDS IN BUFFER
0245   REP   4  LAST 1066   05,3465  24 336 1          INCR   TMINDEX        SET BUFFER INDEX FOR NEXT 2 WORDS.
0246   REP   5  LAST 1066   05,3466  24 336 1          INCR   TMINDEX
0247   REP   4  LAST 1066   05,3467  24 337 0  SNAPAGN  INCR   SUBLIST       SET POINTER TO NEXT 2 WORDS OF SNAPSHOT
0248   REP   5  LAST 1066   05,3470  50 337 0          INDEX  SUBLIST
0249                        05,3471  0 0000 1          0      0              = CA S5S5 (S5S5 = NEXT ENTRY IN SUBLIST)
0250   REP 269  LAST 1066   05,3472  10 000 0          CCS    A              TEST FOR LAST TWO WORDS OF SNAPSHOT.
0251   REP   1              05,3473  1 3456 1          TCF    SNAPLOOP       NOT LAST TWO.
0252   REP   1              05,3474  03357 0  LDNPHAS2 GENADR DNPHASE2
0253   REP   6  LAST 1068   05,3475  54 337 1          TS     SUBLIST        YES, LAST.  SAVE A.
0254   REP  21  LAST 1067   05,3476  3 7716 0          CA     NEGONE         SET DNECADR AND
0255   REP  12  LAST 1066   05,3477  54 336 0          TS     DNECADR            SUBLIST POINTERS
0256   REP   7  LAST 1066   05,3500  56 337 0          XCH    SUBLIST                TO NEGATIVE VALUES.
0257   REP  43  LAST 1066   05,3501  54 003 0          TS     EBANK
0258   REP   4  LAST 1066   05,3502  7 4373 0          MASK   LOW8
0259                        05,3503  0 0006 1          EXTEND
0260   REP 270  LAST 1066   05,3504  5 0000 1          INDEX  A
0261                        E3,1401                    EBANK= 1401
```

L DOWN-TELEMETRY PROGRAM USER'S PAGE NO. 7 EW 83

```
0262                          05,3505  3 1402 0            DCA     1401
0263  REF  26  LAST 1066        0340                       EBANK=  DNTMBUFF
0264  REF   2  LAST 1067     05,3506  1 3535 0  SNAPEND    TCF     DNTMEXIT

0265  REF  13  LAST 1068     05,3507  3 0336 1  FETCH2WD   CA      DNECADR
0266  REF  44  LAST 1068     05,3510  54 003 0              TS      EBANK
0267  REF   5  LAST 1066     05,3511  7 4373 0              MASK    LOW8
0268  REF 156  LAST 1067     05,3512  54 001 1              TS      L
0269  REF   1                05,3513  3 3365 1              CA      DNADRDCR
0270  REF  14  LAST 1069     05,3514  26 336 0              ADS     DNECADR
0271                          05,3515  0 0006 1              EXTEND
0272  REF 157  LAST 1069     05,3516  5 0001 0              INDEX   L
0273                          E3,1400                       EBANK=  1400
0274                          05,3517  3 1401 0              DCA     1400
0275  REF  27  LAST 1069        0340                       EBANK=  DNTMBUFF
0276  REF   3  LAST 1069     05,3520  1 3535 0              TCF     DNTMEXIT

0277  REF   8  LAST 1068     05,3521  54 337 1  DOSUBLST   TS      SUBLIST
0278  REF   9  LAST 1069     05,3522  50 337 0  NEXTINSL   INDEX   SUBLIST
0279                          05,3523  0 0000 1              0       0
0280  REF 271  LAST 1068     05,3524  10 000 0              CCS     A
0281  REF  10  LAST 1069     05,3525  24 337 0              INCR    SUBLIST
0282                          05,3526  1 3532 1              TCF     +4
0283  REF  11  LAST 1069     05,3527  54 337 1              TS      SUBLIST
0284  REF  22  LAST 1068     05,3530  3 7716 0              CA      NEGONE
0285  REF  12  LAST 1069     05,3531  56 337 0              XCH     SUBLIST
0286  REF 272  LAST 1069     05,3532  24 000 1  +4         INCR    A
0287  REF  15  LAST 1069     05,3533  54 336 0              TS      DNECADR
0288  REF   3  LAST 1067     05,3534  1 3420 0              TCF     SETWO +2
A0289
A0290

0291                          05,3535  0 0006 1  DNTMEXIT   EXTEND
0292  REF   1                05,3536  01 034 1              WRITE   DNTM1
0293  REF 158  LAST 1069     05,3537  3 0001 0              CA      L
0294                          05,3540  0 0006 1  TMEXITL    EXTEND
0295  REF   1                05,3541  01 035 0              WRITE   DNTM2
0296  REF  47  LAST 1061     05,3542  1 5222 1  TMRESUME   TCF     RESUME

0297  REF   1                   7710            MINB12     EQUALS  -1/8
0298  REF   6  LAST 1068        0336            DNECADR    EQUALS  TMINDEX
0299  REF   1                   0334            CTLIST     EQUALS  LDATALST
0300  REF   1                   0337            SUBLIST    EQUALS  DNO
```

PICK UP FIRST 2 WORDS OF SNAPSHOT.

NOW GO SEND THEM.

SET EBANK
ISOLATE RELATIVE ADDRESS

DECREMENT COUNT AND ECADR

PICK UP 2 DATA WORDS

NOW GO SEND THEM.

SET SUBLIST POINTER

= CA SSSS (SSSS = NEXT ENTRY IN SUBLIST)
IS IT THE END OF THE SUBLIST
NO-

SAVE A.
SET SUBLIST TO MINUS
RETRIEVE A.

SAVE DNADR
GO USE COMMON CODING(PROBLEMS WOULD
OCCUR IF THE PROGRAM ENCOUNTERED A
DNPTR NOW)

DOWN-TELEMETRY EXIT
TO SEND A + L TO CHANNELS 34 + 35
RESPECTIVELY

EXIT TELEMETRY PROGRAM VIA RESUME.

L DOWN-TELEMETRY PROGRAM USER=S PAGE NO. 8 E0 S3

```
P0301  SUBROUTINE NAME- DNDUMP
R0302  FUNCTIONAL DESCRIPTION - TO SEND(DUMP) ALL ERASABLE STORAGE «N« TIMES.(N = 1 TO 4). BANKS ARE SENT ONE AT A TIME
R0304           EACH BANK IS PRECEEDED BY AN ID WORD, SYNCH BITS, ECADR AND TIME1 FOLLOWED BY THE 256D WORDS OF EACH
R0306           EBANK. EBANKS ARE DUMPED IN ORDER(I.E. EBANK 0 FIRST, THEN EBANK1 ETC.)
R0308  CALLING SEQUENCE- THE GROUND OR ASTRONAUT BY KEYING V74E CAN INITIALIZE THE DUMP.
R0310           AFTER KEYING IN V74E THE CURRENT DOWNLIST WILL BE IMMEDIATELY TERMINATED AND THE DOWNLINK ERASABLE DUMP
R0312           WILL BEGIN.
R0313           ONCE INITIATED THE DOWNLINK ERASABLE DUMP CAN BE TERMINATED (AND INTERRUPTED DOWNLIST REINSTATED) ONLY
R0315           BY THE FOLLOWING'
R0318            1. A FRESH START
R0317            2. COMPLETION OF ALL DOWNLINK DUMPS REQUESTED (ACCORDING TO BITS SET IN DUMPCNT). NOTE THAT DUMPCNT
R0319               CAN BE ALTERED BY A V21N01.
R0320            3. AND INVOLUNTARILY BY A RESTART.
R0321  NORMAL EXIT MODE- TCF DNPHASE1
R0322  ALARM OR ABORT MODE- NONE
R0323  *SUBROUTINES CALLED- NONE.
R0324  ERASABLE INITIALIZATION REQUIRED-
R0325           DUMPCNT   OCT  20000   IF 4 COMPLETE ERASABLE DUMPS ARE DESIRED
R0326           DUMPCNT   OCT  10000   IF 2 COMPLETE ERASABLE DUMPS ARE DESIRED
R0327           DUMPCNT   OCT  04000   IF 1 COMPLETE ERASABLE DUMP  IS  DESIRED
R0328  DEBRIS- DUMPLOC, DUMPSW, DNTMGOTO, EBANK AND CENTRAL REGISTERS
R0329  TIMING-   TIME(IN SECS) = ((NO.DUMPS)*(NO.EBANKS)* (WDSPEREBANK + NO.IDWDS)) / NO.WDSPERSEC
R0331           TIME(IN SECS) = (   4   )*(    8    )* (    256     +     4    ) /     100
R0333       THUS TIME(IN SECS TO SEND DUMP OF ERASABLE 4 TIMES VIA DOWNLINK) = 83.2 SECONDS

R0335  STRUCTURE OF ONE EBANK AS IT IS SENT BY DOWNLINK PROGRAM-
R0336     (REMINDER-THIS ONLY DESCRIBES ONE OF THE 8 EBANKS X 4 (DUMPS) = 32 EBANKS WHICH WILL BE SENT BY DNDUMP)
R0338          DOWNLIST                                          W
R0339           WORD   TAKEN FROM CONTENTS OF    EXAMPLE 0  COMMENTS

R0340             1    ERASID                     0177X  0  DOWNLIST I.D. FOR DOWNLINK ERASABLE DUMP (X=7 CSM, 8 LM)
R0342             2    LOWIDCOD                   77340  1  DOWNLINK SYNCH BITS.(SAME ONE USED IN ALL OTHER DOWNLISTS)
R0344             3    DUMPLOC                    13400  1  (SEE NOTES ON DUMPLOC)1= 3RD ERAS DUMP, 3400=ECADR OF 5TH WD
R0346             4    TIME1                      14120  1  TIME IN CENTISECONDS
R0347             5    FIRST WORD OF EBANK X      03400  1  IN THIS EXAMPLE THIS WORD = CONTENTS OF E7,1400 (ECADR 3400)
R0349             6    2ND   WORD OF EBANK X     00142  1  IN THIS EXAMPLE THIS WORD = CONTENTS OF E7,1401 (ECADR 3401)
R0351             7    3RD   WORD OF EBANK X     00142  1  IN THIS EXAMPLE THIS WORD = CONTENTS OF E7,1402 (ECADR 3402)
R0353             .                               .  1
R0354             .                               .  1
R0355             .                               .  1
R0358           200D   256TH WORD OF EBANK X      03777  1  IN THIS EXAMPLE THIS WORD = CONTENTS OF E7,1777 (ECADR 3777)

R0356  NOTE- DUMPLOC CONTAINS THE COUNTER AND ECADR FOR EACH WORD BEING SENT.
R0359       THE BIT STRUCTURE OF DUMPLOC IS FOLLOWS---
R0380                                    X = NOT USED
R0381          X ABC EEE RRRRRRRR      ABC = ERASABLE DUMP COUNTER(I.E. ABC = 0,1,2 OR 3 WHICH MEANS THAT
R0383                                        COMPLETE ERASABLE DUMP NUMBER  1,2,3 OR 4 RESPECTIVELY IS IN PROGRESS)
R0385                                  EEE = EBANK BITS
R0388                             RRRRRRRR = RELATIVE ADDRESS WITHIN AN EBANK.
```

L DOWN-TELEMETRY PROGRAM

```
0368  REF 208  LAST 1068   05,3543  3 4714 1  DNDUMPI  CA    ZERO      INITIALIZE DOWNLINK
0369  REF   1               05,3544  54 338 0           TS    DUMPLOC   ERASABLE DUMP
0370  REF   2  LAST 1087   05,3545  0 3607 0   +2      TC    SENDID    GO SEND ID AND SYNCH BITS
0371  REF   1               05,3546  3 3555 1           CA    LDNDUMP1  SET DNTMGOTO
0372  REF   5  LAST 1088   05,3547  54 335 0           TS    DNTMGOTO  TO LOCATION FOR NEXT PASS
0373  REF  18  LAST 1061   05,3550  3 0025 0           CA    TIME1     PLACE TIME1
0374  REF 159  LAST 1089   05,3551  58 001 0           XCH   L         INTO L
0375  REF   2  LAST 1071   05,3552  3 0338 1           CA    DUMPLOC   AND ECADR OF THIS EBANK INTO A
0376  REF   4  LAST 1069   05,3553  1 3535 0           TCF   DNTMEXIT  SEND DUMPLOC AND TIME1

0377  REF   1               05,3554   03556 1  LDNDUMP  ADRES DNDUMP
0378  REF   1               05,3555   03571 1  LDNDUMP1 ADRES DNDUMP1

0379  REF  51  LAST 1057   05,3556  3 4711 1  DNDUMP   CA    TWO       INCREMENT ECADR IN DUMPLOC
0380  REF   3  LAST 1071   05,3557  26 338 0           ADS   DUMPLOC   TO NEXT DP WORD TO BE
0381  REF   6  LAST 1089   05,3560  7 4373 0           MASK  LOW8      DUMPED AND SAVE IT.
0382  REF 273  LAST 1069   05,3561  10 000 0           CCS   A         IS THIS THE BEGINNING OF A NEW EBANK
0383  REF   1               05,3562  1 3573 1           TCF   DNDUMP2   NO- THEN CONTINUE DUMPING
0384  REF   4  LAST 1071   05,3563  3 0338 1           CA    DUMPLOC   YES- IS THIS THE END OF THE
0385  REF   1               05,3564  7 0333 0           MASK  DUMPCNT   N TH(N = 1 TO 4) COMPLETE ERASABLE
0386  REF   7  LAST  988   05,3565  7 7871 1           MASK  PRIO34    DUMP(BIT14 FOR 4, BIT13 FOR 2 OR BIT12
0387  REF 274  LAST 1071   05,3566  10 000 0           CCS   A         FOR 1 COMPLETE ERASABLE DUMP(5)).
0388  REF   2  LAST  188   05,3567  1 3351 1           TCF   DNPHASE1  YES- START SENDING INTERRUPTED DOWNLIST
A0389                                                                 AGAIN
0390  REF   2  LAST  254   05,3570  1 3545 1           TCF   DNDUMPI +2  NO- GO BACK AND INITIALIZE NEXT BANK

0391  REF   1               05,3571  3 3554 0  DNDUMP1  CA    LDNDUMP   SET DNTMGOTO
0392  REF   6  LAST 1071   05,3572  54 335 0           TS    DNTMGOTO  FOR WORDS 3 TO 256D OF CURRENT EBANK

0393  REF   5  LAST 1071   05,3573  3 0336 1  DNDUMP2  CA    DUMPLOC
0394  REF  45  LAST 1069   05,3574  54 003 0           TS    EBANK     SET EBANK
0395  REF   7  LAST 1071   05,3575  7 4373 0           MASK  LOW8      ISOLATE RELATIVE ADDRESS.
0396  REF 211  LAST 1068   05,3576  54 002 1           TS    Q         (NOTE' MASK INSTRUCTION IS USED TO PICK
0397  REF  14  LAST  695   05,3577  3 4713 0           CA    NEG0      UP ERASABLE REGISTERS SO THAT EDITING
0398  REF 160  LAST 1071   05,3600  54 001 1           TS    L         REGISTERS 20-23 WILL NOT BE ALTERED.)
0399  REF 212  LAST 1071   05,3601  50 002 0           INDEX Q
0400                       E3,1400                    EBANK= 1400     PICK UP LOW ORDER REGISTER OF PAIR
0401                       05,3602  7 1401 1          MASK  1401      OF ERASABLE REGISTERS.
0402  REF 161  LAST 1071   05,3603  58 001 0           XCH   L
0403  REF 213  LAST 1071   05,3604  50 002 0           INDEX Q         PICK UP HIGH ORDER REGISTER OF PAIR
0404                       05,3605  7 1400 0           MASK  1400      OF ERASABLE REGISTERS.
0405  REF  28  LAST 1069     0340                     EBANK= DNTMBUFF
0408  REF   5  LAST 1071   05,3606  1 3535 0           TCF   DNTMEXIT  GO SEND THEM
0407                       05,3607  0 0006 1  SENDID   EXTEND          **ENTRANCE USED BY ERASABLE DUMP PROG.**
0408  REF   7  LAST 1071   05,3610  22 335 1           QXCH  DNTMGOTO  SET DNTMGOTO SO NEXT TIME PROG WILL GO
0409  REF   1               05,3611  3 4747 1           CAF   ERASID    TO LOCATION FOLLOWING 'TC SENDID'

0410  REF 162  LAST 1071   05,3612  54 001 1           TS    L         **ENTRANCE USED BY REGULAR DOWNLINK PG**
```

L DOWN-TELEMETRY PROGRAM

USER-S PAGE NO. 10 E0 S3

```
0411  REP   2  LAST 1067   05,3613  0 3441 0      TC     WOZERO      GO SET WORD ORDER CODE TO ZERO
0412  REP   1               05,3614  3 2000 0      CAF    LOWIDCOD    PLACE SPECIAL ID CODE INTO L
0413  REP 163  LAST 1071   05,3615  56 001 0      XCH    L           AND ID BACK INTO A
0414  REP   6  LAST 1071   05,3616  1 3535 0      TCF    DNTMEXIT    SEND DOWNLIST ID CODE(S).
```

```
R0001           THE FOLLOWING ROUTINE CAN BE USED TO CALL A SUBROUTINE IN ANOTHER BANK. IN THE BANKCALL VERSION, THE
R0003   CADR OF THE SUBROUTINE IMMEDIATELY FOLLOWS THE  TC BANKCALL  INSTRUCTION, WITH C(A) AND C(L) PRESERVED.

 0005                           4555                    BLOCK  02
 00055  REF   1                                         COUNT  02/BANK

 0006   REF   4  LAST  413      4555  52 134 0  BANKCALL DXCH  BUP2          SAVE INCOMING A,L.
 0007   REF 214  LAST 1071      4556  50 002 0           INDEX  Q             PICK UP CADR.
 0008                           4557  3 0000 1           CA     0
 0009   REF 215  LAST 1073      4560  24 002 0           INCR   Q             SO WE RETURN TO THE LOC. AFTER THE CADR.

R0010           SWCALL IS IDENTICAL TO BANKCALL, EXCEPT THAT THE CADR ARRIVES IN A.

 0012   REF 164  LAST 1072      4561  54 001 1  SWCALL   TS     L
 0013   REF   3  LAST  376      4562  22 004 0           LXCH   FBANK         SWITCH BANKS, SAVING RETURN.
 0014   REF   7  LAST  613      4563  7 4747 0           MASK   LOW10         GET SUB-ADDRESS OF CADR.
 0015   REF 216  LAST 1073      4564  56 002 0           XCH    Q             A,L NOW CONTAINS DP RETURN.
 0016   REF   5  LAST 1073      4565  52 134 0           DXCH   BUP2          RESTORING INPUTS IF THIS IS A BANKCALL.
 0017   REF 217  LAST 1073      4566  50 002 0           INDEX  Q
 0018                           4567  0 2000 0           TC     10000         SETTING Q TO SWRETURN.

 0019   REF   6  LAST 1073      4570  56 134 1  SWRETURN XCH   BUP2 +1        COMES HERE TO RETURN TO CALLER. C(A,L)
 0020   REF   4  LAST 1073      4571  56 004 0           XCH    FBANK         ARE PRESERVED FOR RETURN.
 0021   REF   7  LAST 1073      4572  56 134 1           XCH    BUP2 +1
 0022   REF   8  LAST 1073      4573  0 0133 0           TC     BUP2
R0023           THE FOLLOWING ROUTINE CAN BE USED AS A UNILATERAL JUMP WITH C(A,L) PRESERVED AND THE CADR IMMEDIATELY
R0025   FOLLOWING THE TC POSTJUMP INSTRUCTION.

 0026   REF 218  LAST 1073      4574  56 002 0  POSTJUMP XCH   Q             SAVE INCOMING C(A).
 0027   REF 275  LAST 1071      4575  50 000 1           INDEX  A             GET CADR.
 0028                           4576  3 0000 1           CA     0

R0029           BANKJUMP IS THE SAME AS POSTJUMP, EXCEPT THAT THE CADR ARRIVES IN A.

 0031   REF   5  LAST 1073      4577  54 004 1  BANKJUMP TS     FBANK
 0032   REF   8  LAST 1073      4600  7 4747 0           MASK   LOW10
 0033   REF 219  LAST 1073      4601  56 002 0           XCH    Q             RESTORING INPUT C(A) IF THIS WAS A
 0034   REF 220  LAST 1073      4602  50 002 0  Q+10000  INDEX  Q             POSTJUMP.
 0035                           4603  1 2000 1  PRIO12   TCF    10000         PRIO12 = TCF   10000 = 12000
```

P0036 THE FOLLOWING ROUTINE GETS THE RETURN CADR SAVED BY SWCALL OR BANKCALL AND LEAVES IT IN A.

```
0036   REF    9  LAST 1073     4604  3 4747 1  MAKECADR CAF    LOW10
0039   REF    9  LAST 1073     4605  7 0133 1           MASK   BUF2
0040   REF   10  LAST 1074     4606  6 0134 1           AD     BUF2 +1
0041   REF  221  LAST 1073     4607  0 0002 0           TC     Q
00465  REF    4  LAST  374     4610  54 135 1  SUPDACAL TS     MPTEMP
0047   REF    6  LAST 1073     4611  56 004 0           XCH    FBANK          SET FBANK FOR DATA.
00475                          4612  0 0006 1           EXTEND
0048   REF   10  LAST  577     4613  04 007 1           ROR    SUPERBNK       SAVE FBANK IN BITS 15-11, AND
00465  REF    5  LAST 1074     4614  56 135 0           XCH    MPTEMP          SUPERBANK IN BITS 7-5.
0049   REF   10  LAST 1074     4615  7 4747 0           MASK   LOW10
00495  REF  165  LAST 1073     4616  56 001 0           XCH    L              SAVE REL. ADR. IN BANK, FETCH SUPERBITS.
0050                           4617  0 0004 0           INHINT                BECAUSE RUPT DOES NOT SAVE SUPERBANK.
00505                          4620  0 0006 1           EXTEND
0051   REF   11  LAST 1074     4621  01 007 1           WRITE  SUPERBNK       SET SUPERBANK FOR DATA.
0052   REF  166  LAST 1074     4622  50 001 0           INDEX  L
00525                          4623  3 2000 0           CA     10000          PINBALL (FIX MEM DISP) PREVENTS DCA HERE
0053   REF    6  LAST 1074     4624  56 135 0           XCH    MPTEMP         SAVE 1ST WD, FETCH OLD FBANK AND SBANK.
00534                          4625  0 0006 1           EXTEND
00535  REF   12  LAST 1074     4626  01 007 1           WRITE  SUPERBNK       RESTORE SUPERBANK.
0054                           4627  0 0003 1           RELINT
00545  REF    7  LAST 1074     4630  54 004 1           TS     FBANK          RESTORE FBANK.
0055   REF    7  LAST 1074     4631  3 0135 0           CA     MPTEMP         RECOVER FIRST WORD OF DATA.
00555                          4632  0 0002 0           RETURN                24 WDS. DATACALL 516 MU, SUPDACAL 432 MU
```

P0056 THE FOLLOWING ROUTINES ARE IDENTICAL TO BANKCALL AND SWCALL EXCEPT THAT THEY ARE USED IN INTERRUPT.

```
0058  REF   2  LAST  415    4633  52 073 1  IBNKCALL DXCH   RUPTREG3      USES RUPTREG3,4 FOR DP RETURN ADDRESS.
0059  REF 222  LAST 1074    4634  50 002 0           INDEX  Q
0060                       4635  3 0000 1           CAF    0
0061  REF 223  LAST 1075    4636  24 002 0           INCR   Q

0062  REF 167  LAST 1074    4637  54 001 1  ISWCALL  TS     L
0063  REF   8  LAST 1074    4640  22 004 0           LXCH   FBANK
0064  REF  11  LAST 1074    4641  7 4747 0           MASK   LOW10
0065  REF 224  LAST 1075    4642  56 002 0           XCH    Q
0066  REF   3  LAST 1075    4643  52 073 1           DXCH   RUPTREG3
0067  REF 225  LAST 1075    4644  50 002 0           INDEX  Q
0068                       4645  0 2000 0           TC     10000

0069  REF   3  LAST   66    4646  56 073 0  ISWRETRN XCH    RUPTREG4
0070  REF   9  LAST 1075    4647  56 004 0           XCH    FBANK
0071  REF   4  LAST 1075    4650  56 073 0           XCH    RUPTREG4
0072  REF   4  LAST 1075    4651  0 0072 1           TC     RUPTREG3
```

R0090 2. USPRCADR ACCESSES INTERPRETIVE CODING IN OTHER THAN THE USER'S FBANK. THE CALLING SEQUENCE IS AS FOLLOWS'

```
A0092                                      L       TC     USPRCADR
A0093                                      L+1     CADR   INTPRETX     INTPRETX IS THE INTERPRETIVE CODING
A0094                                                                  RETURN IS TO L+2

0103  REF   5  LAST  415    4652  54 164 0  USPRCADR TS     LOC          SAVE A
0104  REF  25  LAST  918    4653  3 4703 1           CA     BIT8
0105  REF   7  LAST  365    4654  54 023 1           TS     EDOP         EXIT INSTRUCTION TO EDOP
0106  REF  14  LAST  575    4655  3 0006 1           CA     BBANK
0107  REF   1                4656  54 165 1           TS     BANKSET      USER'S BBANK TO BANKSET
0108  REF 226  LAST 1075    4657  50 002 0           INDEX  Q
0109                       4660  3 0000 1           CA     0
0110  REF  10  LAST 1075    4661  54 004 1           TS     FBANK        INTERPRETIVE BANK TO FBANK
0111  REF  12  LAST 1075    4662  7 4747 0           MASK   LOW10        YIELDS INTERPRETIVE RELATIVE ADDRESS
0112  REF 227  LAST 1075    4663  56 002 0           XCH    Q            INTERPRETIVE ADDRESS TO Q, FETCHING L+1
0113  REF   6  LAST 1075    4664  56 164 1           XCH    LOC          L+1 TO LOC, RETRIEVING ORIGINAL A
0114  REF   1                4665  1 4602 0           TCF    Q+10000
```

P0117 THERE ARE FOUR POSSIBLE SETTINGS FOR CHANNEL 07. (CHANNEL 07 CONTAINS THE SUPERBANK SETTING.)
R0119
R0120 SUPERBANK SETTING S-REG. VALUE PSEUDO-FIXED BANK NUMBERS OCTAL PSEUDO ADDRESSES
R0121 ---------- ------- ------------ ------------ ------------

R0122 SUPERBANK 3 0XX 2000 - 3777 30 - 37 70000 - 107777 (WHERE XX CAN BE ANYTHING AND
R0124 WILL USUALLY BE SEEN AS 11)
R0126 SUPERBANK 4 100 2000 - 3777 40 - 47 110000 - 127777 (AS FAR AS IT CAN BE SEEN,
R0128 ONLY BANKS 40-43 WILL EVER BE
R0130 AND ARE PRESENTLY AVAILABLE)
R0132 SUPERBANK 5 101 2000 - 3777 50 - 57 130000 - 147777 (PRESENTLY NOT AVAILABLE TO
R0134 THE USER)
R0136 SUPERBANK 6 110 2000 - 3777 60 - 67 150000 - 167777 (PRESENTLY NOT AVAILABLE TO
R0138 THE USER)

R0142 *** THIS ROUTINE MAYBE CALLED BY ANY PROGRAM LOCATED IN BANKS 00 - 27. I.E., NO PROGRAM LIVING IN ANY
R0144 SUPERBANK SHOULD USE SUPERSW. ***

R0145 SUPERSW MAYBE CALLED IN THIS FASHION'

```
R0146          CAF   ABBCON        WHERE -- ABBCON  BBCON  SOMETHIN --
R0147          TCR   SUPERSW       (THE SUPERBNK BITS ARE IN THE BBCON)
R0148          ...    ...
R0149          .      .
R0150          .      .
```

R0151 OR IN THIS FASHION '

```
R0152          CAF   SUPERSET      WHERE SUPERSET IS ONE OF THE FOUR AVAILABLE
R0154          TCR   SUPERSW       SUPERBANK BIT CONSTANTS'
R0155          ...    ...
R0157          .      .                          SUPER011 OCTAL  60
R0159          .      .                          SUPER100 OCTAL 100
R0161                                            SUPER101 OCTAL 120
                                                 SUPER110 OCTAL 140
```

```
 0163                        4666  0 0006 1  SUPERSW  EXTEND
 0164  REF  13  LAST 1074    4667  01 007 1           WRITE   SUPERBNK   WRITE BITS 7-6-5 OF THE ACCUMULATOR INTO
A0165                                                                   CHANNEL 07
 0166  REF 228  LAST 1075    4670  0 0002 0           TC      0          TC TO INSTRUCTION FOLLOWING
A0167                                                                    TC  SUPERSW
```